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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : C23C 14/34

A1

(11) International Publication Number: WO 92/17621

(43) International Publication Date: 15 October 1992 (15.10.92)

(21) International Application Number: PCT/US92/00722

(22) International Filing Date: 29 January 1992 (29.01.92)

(30) Priority data:
681,866 4 April 1991 (04.04.91) US

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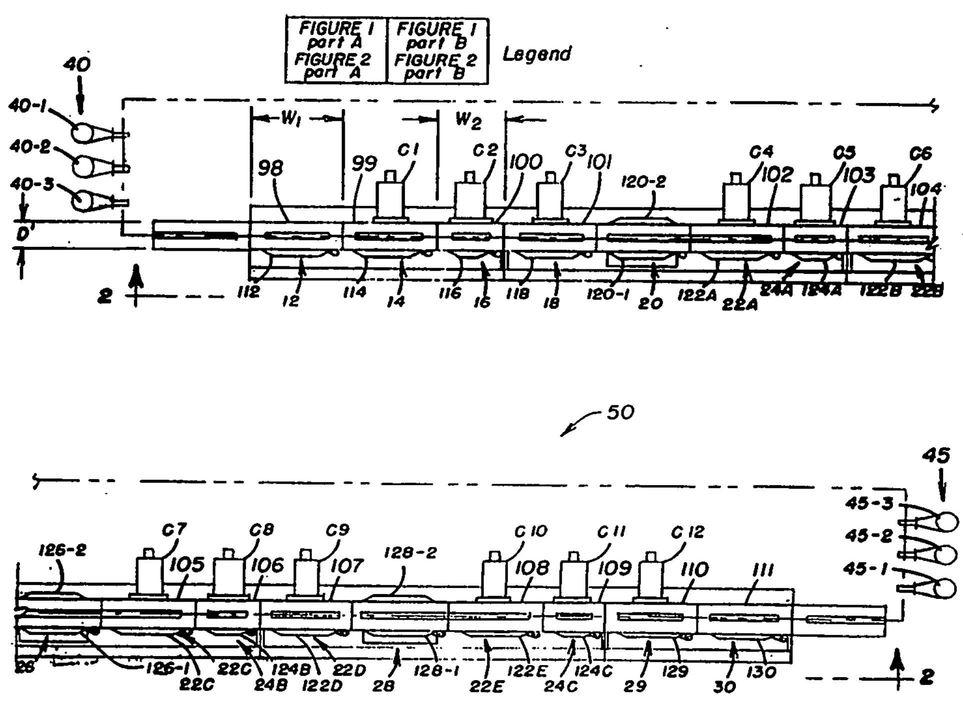
(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), MC (European patent), NL (European patent), SE (European patent).

Published
With international search report.

(54) Title: APPARATUS AND METHOD FOR HIGH THROUGHPUT SPUTTERING

(57) Abstract

An apparatus provides a single or multi-layer coating to the surface of a plurality of substrates. The apparatus includes a plurality of buffer and sputtering chambers (12, 18, 20, 22A-E, 24A-C, 26 and 28-30), and an input end and an output end. The substrates are transported through said chambers (12, 18, 20, 22A-E, 24A-C, 26 and 28-30) at varying rates of speed. The apparatus may further include means for transporting a plurality of substrates through sputtering chambers (20, 26, 28) at variable velocities; means for reducing the ambient pressure within the sputtering chambers (20, 26, 28) to a vacuum level to enable sputtering operation; means for heating the substrates to a temperature conducive to sputtering coatings thereon providing a substantially uniform temperature profile over the surface of the substrates; and control means for providing control signals to and for receiving feedback input from, said sputtering chambers (20, 26, 28), means for transporting, means for reducing, and means for heating, the control means being programmable for allowing control over the means for sputtering, transporting, reducing and heating.



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APPARATUS AND METHOD FOR HIGH THROUGHPUT SPUTTERING

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an apparatus and method for depositing multilayer thin films in a magnetron sputtering process. More particularly, the invention relates to an apparatus and method for depositing thin magnetic films for magnetic recording media in a high volume, electronically controlled, magnetron sputtering process, and to production of an improved magnetic recording disk product thereby.

2. Description of the Related Art

Sputtering is a well-known technique for depositing uniform thin films on a particular substrate. Sputtering is performed in an evacuated chamber using an inert gas, typically argon, with one or more substrates remaining static during deposition, being rotated about

the target (a "planetary" system) or being transported past the target (an "in-line" system).

Fundamentally, the technique involves bombarding the surface of a target material to be deposited as the film with electrostatically accelerated argon ions. Generally, electric fields are used to accelerate ions in the plasma gas, causing them to impinge on the target surface. As a result of momentum transfer, atoms and electrons are dislodged from the target surface in an area known as the erosion region. Target atoms deposit on the substrate, forming a film.

Typically, evacuation of the sputtering chamber is a two-stage process in order to avoid contaminant-circulating turbulence in the chamber. First, a throttled roughing stage slowly pumps down the chamber to a first pressure, such as about 50 microns. Then, high vacuum pumping occurs using turbo-, cryo- or diffusion pumps to evacuate the chamber to the highly evacuated base pressure (about 10^{-7} Torr) necessary to perform sputtering. Sputtering gas is subsequently provided in the evacuated chamber, backfilling to a pressure of about 2-10 microns.

The sputtering process is useful for depositing coatings from a plurality of target materials onto a variety of substrate materials, including glass, nickel-phosphorus plated aluminum disks, and ceramic materials. However, the relatively low sputtering rate achieved by the process solely relying on electrostatic forces (diode sputtering) may be impracticable for certain commercial applications where high volume processing is desired. Consequently, various magnet arrangements have been used to enhance the sputtering rate by trapping electrons close to the target surface, ionizing more argon, increasing the probability of impacting and

dislodging target atoms and therefore the sputtering rate. In particular, an increased sputtering rate is achieved by manipulation of a magnetic field geometry in the region adjacent to the target surface.

Sputter deposition performed in this manner is generally referred to as magnetron sputtering.

The magnetic field geometry may be optimized by adjusting the polarity and position of individual magnets used to generate magnetic fields with the goal of using the magnetic field flux paths to enhance the sputtering rate. For example, U.S. Patent No. 4,166,018, issued August 28, 1989 to J. S. Chapin and assigned to Airco, Inc., describes a planar direct current (d.c.) magnetron sputtering apparatus which uses a magnet configuration to generate arcuate magnetic flux paths (or lines) that confine the electrons and ions in a plasma region immediately adjacent to the target erosion region. A variety of magnet arrangements are suitable for this purpose, as long as one or more closed loop paths of magnetic flux is parallel to the cathode surface, e.g., concentric ovals or circles.

The role of the magnetic field is to trap moving electrons near the target. The field generates a force on the electrons, inducing the electrons to take a spiral path about the magnetic field lines. Such a spiral path is longer than a path along the field lines, thereby increasing the chance of the electron ionizing a plasma gas atom, typically argon. In addition, field lines also reduce electron repulsion away from a negatively biased target. As a result, a greater ion flux is created in the plasma region adjacent to the target with a correspondingly enhanced erosion of target atoms from an area which conforms to a shape approximating the inverse shape of the field lines.

Thus, if the field above the target is configured in arcuate lines, the erosion region adjacent to the field lines conforms to a shallow track, leaving much of the target unavailable for sputtering.

Even lower target utilization is problematic for magnetic targets because magnetic field lines tend to be concentrated within, and just above, a magnetic target. With increasing erosion of the magnetic target during sputtering, the field strength above the erosion region increases as more field lines 'leak' out from the target, trapping more electrons and further intensifying the plasma close to the erosion region. Consequently, the erosion region is limited to a narrow valley.

In addition to achieving high film deposition rates, sputtering offers the ability to tailor film properties to a considerable extent by making minor adjustments to process parameters. Of particular interest are processes yielding films with specific crystalline microstructures and magnetic properties. Consequently, much research has been conducted on the effects of sputtering pressures, deposition temperature and maintenance of the evacuated environment to avoid contamination or degradation of the substrate surface before film deposition.

Alloys of cobalt, nickel and chromium deposited on a chromium underlayer (CoNiCr/Cr) are highly desirable as films for magnetic recording media such as disks utilized in Winchester-type hard disk drives. However, on disk substrates, in-line sputtering processes create magnetic anisotropies which are manifested as signal waveform modulations and anomalies in the deposited films.

Anisotropy in the direction of disk travel through such in-line processes is understood to be caused by

crystalline growth perpendicular to the direction of disk travel as a result of the deposition of the obliquely incident flux of target atoms as the disk enters and exits a sputtering chamber. Since magnetic film properties depend on crystalline microstructure, such anisotropy in the chromium underlayer can disrupt the subsequent deposition of the magnetic CoNiCr layer in the preferred orientation. The preferred crystalline orientation for the chromium underlayer is with the closely packed, bcc {110} plane parallel to the film surface. This orientation for the chromium nucleating layer forces the 'C' axis of the hcp structure of the magnetic cobalt-alloy layer, i.e., the easy axis of magnetization, to be aligned in the film plane. Similarly, the orientation of the magnetic field generated in the sputtering process may induce an additional anisotropy which causes similar signal waveform modulations. See, Uchinami, et al., "Magnetic Anisotropies in Sputtered Thin Film Disks", IEEE Trans. Magn., Vol. MAG-23, No. 5, 3408-10, Sept. 1987, and Hill, et al., "Effects of Process Parameters on Low Frequency Modulation on Sputtered Disks for Longitudinal Recording", J. Vac Sci. Tech., Vol. A4, No. 3, 547-9, May 1986 (describing magnetic anisotropy phenomena).

Several approaches have been taken to eliminate the aforementioned waveform modulation problems while enhancing magnetic properties in the coating, especially coercivity. For instance, U.S. Patent No. 4,816,127, issued March 28, 1989 to A. Eltoukhy and assigned to Xidex Corp., describes one means for shielding the substrate to intercept the obliquely incident target atoms. In addition, Teng, et al., "Anisotropy-Induced Signal Waveform Modulation of DC Magnetron Sputtered Thin Films", IEEE Trans. Magn., Vol. MAG-22, 579-581,

1986, and Simpson, et al., "Effect of Circumferential Texture on the Properties of Thin Film Rigid Recording Disks", IEEE Trans. Magn., Vol. MAG-23, No. 5, 3405-7, Sept. 1987, suggest texturizing the disk substrate surface prior to film deposition. In particular, the authors propose circumferential surface grooves to promote circumferentially oriented grain growth and thereby increase film coercivity.

Other approaches to tailoring film properties have focused on manipulating the crystalline microstructure by introducing other elements into the alloy composition. For example, Shiroishi, et al., "Read and Write Characteristics of Co-Alloy/Cr Thin Films for Longitudinal Recording", IEEE Trans. Magn., Vol. MAG-24, 2730-2, 1988, and U.S. Patent No. 4,652,499, issued March 24, 1987 to J. K. Howard and assigned to IBM, relate to the substitution of elements such as platinum (Pt), tantalum (Ta), and zirconium (Zr) into cobalt-chromium (CoCr) films to produce higher coercivity and higher corrosion resistance in magnetic recording films.

CoCr alloys with tantalum (CoCrTa) are particularly attractive films for magnetic recording media. For example, it is known in the prior art to produce CoCrTa films by planetary magnetron sputtering processes using individual cobalt, chromium and tantalum targets or using cobalt-chromium and tantalum targets.

Fisher, et al., "Magnetic Properties and Longitudinal Recording Performance of Corrosion Resistant Alloy Films", IEEE Trans. Magn., Vol. MAG 22, no. 5, 352-4, Sept. 1986, describe a study of the magnetic and corrosion resistance properties of sputtered CoCr alloy films. Substitution of 2 atomic percent (at.%) Ta for Cr in a Co-16 at.% Cr alloy (i.e., creating a Co-14 at.% Cr-2 at.% Ta alloy) was found to

improve coercivity without increasing the saturation magnetization. In particular, a coercivity of 1400 Oe was induced in a 400 Å film. In addition, linear bit densities from 8386 flux reversals/cm to 1063 flux reversals/cm (21300 fci to 28100 fci) were achieved at -3 dB, with a signal-to-noise (SNR) ratio of 30 dB. Moreover, corrosion resistance of CoCr and CoCrTa films was improved relative to CoNi films.

U.S. Patent No. 4,940,548, issued on August 21, 1990 to Furusawa, et al., and assigned to Hitachi, Ltd., discloses the use of Ta to increase the coercivity and corrosion resistance of CoCr (and CoNi) alloys. CoCr alloys with 10 at.% Ta (and chromium content between 5 and 25 at.%) were sputtered onto multiple layers of chromium to produce magnetic films with low modulation even without texturing the substrate surface and highly desirable crystalline microstructure and magnetic anisotropy.

Development of a high throughput in-line system to produce sputtered CoCrTa films with enhanced magnetic and corrosion-resistance properties for the magnetic recording media industry has obvious economic advantages.

Linear recording density of magnetic films on media used in Winchester-type hard disk drives is known to be enhanced by decreasing the flying height of the magnetic recording head above the recording medium. With reduced flying height, there is an increased need to protect the magnetic film layer from wear. Magnetic films are also susceptible to corrosion from vapors present even at trace concentrations within the magnetic recording system. A variety of films have been employed as protective overlayers for magnetic films, including rhodium, carbon and inorganic nonmetallic carbides,

nitrides and oxides, like silica or alumina. However, problems such as poor adhesion to the magnetic layer and inadequate wear resistance have limited the applicability of these films. U.S. Patent No. 4,503,125 issued on March 3, 1985 to Nelson, et al. and assigned to Xebec, Inc. describes a protective carbon overcoating for magnetic films where adhesion is enhanced by chemically bonding a sputtered layer of titanium between the magnetic layer and the carbon overcoating.

In the particular case of sputtered carbon, desirable film properties have been achieved by carefully controlling deposition parameters. For example, during the sputtering process, the amount of gas incorporated in the growing film depends on sputtering parameters like target composition, sputtering gas pressure and chamber geometry. U.S. Patent No. 4,839,244, issued on June 13, 1989 to Y. Tsukamoto and assigned to NEC Corp., describes a process for co-sputtering a protective graphite fluoride overlayer with an inorganic nonmetallic compound in a gaseous atmosphere which includes fluorine gas. U.S. Patent No. 4,891,114 issued on January 1, 1990 to Hitzfeld, et al., and assigned to BASF Aktiengesellschaft of Germany, relates to a d. c. magnetron sputtering process for an amorphous carbon protective layer using a graphitic carbon target.

As the wear-resistant layer for magnetic recording media, it is desirable that the carbon overlayer have a microcrystalline structure corresponding to high hardness. In other words, it is desirable during sputtering to minimize graphitization of carbon which softens amorphous carbon films. One means employed to moderate graphitization of sputtered carbon films is by incorporating hydrogen into the film. Such

incorporation may be accomplished by sputtering in an argon atmosphere mixed with hydrogen or a hydrogen-containing gas, such as methane or other hydrocarbons.

Magnetron sputtering processes have been developed which have been somewhat successful in achieving high throughput. For example, U.S. Patent Nos. 4,735,840 and 4,894,133 issued to Hedgcoth on April 5, 1988 and April 16, 1990, respectively, describe a high volume planar d. c. magnetron in-line sputtering apparatus which forms multilayer magnetic recording films on disks for use in Winchester-type hard disk technology. The apparatus includes several consecutive regions for sputtering individual layers within a single sputtering chamber through which preheated disk substrates mounted on a pallet or other vertical carrier proceed at velocities up to about 10 mm/sec (1.97 ft/min), though averaging only about 3 mm/sec (0.6 ft/min). The first sputtering region deposits chromium (1,000 to 5,000 Å) on a circumferentially textured disk substrate. The next region deposits a layer (200 to 1,500 Å) of a magnetic alloy such as CoNi. Finally, a protective layer (200 to 800 Å) of a wear- and corrosion-resistant material such as amorphous carbon is deposited.

The apparatus is evacuated by mechanical and cryo pumps to a base pressure about 2 x 10^{-7} Torr. Sputtering is performed at a relatively high argon pressure between 2 and 4 x 10^{-2} Torr (20 to 40 microns) to eliminate anisotropy due to obliquely incident flux.

In optimizing a sputtering process to achieve high throughput, consideration should be given to other time-influenced aspects of the process apart from the sputtering rate. For example, substrate heating is typically accomplished with heaters requiring an extended dwell time to warm substrates to a desired

equilibrium temperature. In addition, substrate transport speeds through the sputtering apparatus have been limited with respect to mechanisms using traditional bottom drive, gear/belt-driven transport systems. Such bottom drive systems generally have intermeshing gears and may be practically incapable of proceeding faster than a particular rate due to rough section-to-section transitions which may dislodge substrates from the carrier and/or create particulate matter from gear wear which contaminates the disks prior to or during the sputtering process. Thus, overall process throughput would be further enhanced by the employment of heating and transport elements which require minimal time to perform these functions.

Generally, prior art sputtering devices utilize relatively unsophisticated means for controlling the sputtering processes described therein. Such control systems may comprise standard optical or electrical metering monitored by a system operator, with direct electrical or electro-mechanical switching of components utilized in the system by the system operator. Such systems have been adequately successful for limited throughput of sputtered substrates. However, a more comprehensive system is required for higher throughput sputtering operations. Specifically, a control system is required which provides to the operator an extensive amount of information concerning the ongoing process through a relatively user-friendly environment. In addition, the control system must adequately automate functions both in series and in parallel where necessary to control every aspect of the sputtering system. Further, it is desirable to include within such a control system the capability to preset a whole series of operating parameters to facilitate rapid set-up of

the system for processes employing myriad sputtering conditions.

SUMMARY OF THE INVENTION

Thus, an object of the present invention is to provide a high throughput sputtering process and apparatus.

A further object of the present invention is to provide a control system for the apparatus and process which continuously monitors and facilitates alteration of film deposition process parameters.

A further object of the present invention is to provide a high throughput sputtering apparatus with a centralized electronic control system.

An additional object of this invention is to provide the above objects in a means by which sputtering is achieved in a highly efficient, contaminant-free environment.

An additional object of this invention is to provide a highly versatile, contaminant-free means for transporting substrates through the apparatus and process.

A further object of this invention is to transport substrates through the sputtering apparatus by means of an overhead, gearless transport mechanism.

A further object of this invention is to provide a transport mechanism for carrying a plurality of substrates, each at a user-defined, variable speed.

A further object of this invention is to maintain a contaminant-free environment within the sputtering apparatus by means of a high speed, high capacity vacuum pump system.

A further object of this invention is to provide a magnetron design allowing efficient erosion of target material during the sputtering process.

A further object of this invention is to provide a high throughput sputtering apparatus which achieves and maintains a uniform substrate surface temperature profile before film deposition.

A further object of this invention is to provide a highly isotropic film by minimizing deposition by target atoms impinging on the substrate surface at high angles of incidence.

A further object of this invention is to provide high throughput sputtering apparatus which minimizes oxidation of the chromium underlayer before magnetic film deposition.

An additional object of the present invention is to provide high quality thin magnetic films on magnetic recording media with superior magnetic recording properties.

A further object of this invention is to provide high quality thin cobalt-chromium-tantalum (CoCrTa) films with superior magnetic recording properties.

A further object of this invention is to provide high quality sputtered thin magnetic films circumferentially oriented along the easy magnetic axis.

A further object of this invention is to provide high throughput sputtering apparatus for high quality thin carbon films with superior wear, hardness, corrosion and elastic properties.

A further object of this invention is to provide a method for depositing wear-resistant carbon films comprising sputtering in the presence of a hydrogen-containing gas.

A further object of this invention is to provide an improved method for sputtering carbon films using either an electrically biased or grounded pallet.

These and other objects of the invention are accomplished in a high throughput sputtering apparatus and process capable of producing sputtered substrates at a rate of up to five times greater than the prior art. An apparatus in accordance with the present invention provides a single or multi-layer coating to the surface of a plurality of substrates. Said apparatus includes a plurality of buffer and sputtering chambers, and an input end and an output end, wherein said substrates are transported through said chambers of said apparatus at varying rates of speed such that the rate of speed of a pallet from said input end to said output end is a constant for each of said plurality of pallets. A high throughput sputtering apparatus having a plurality of integrally matched components in accordance with the present invention may comprise means for sputtering a multi-layer coating onto a plurality of substrates, said means for sputtering including a series of sputtering chambers each having relative isolation from adjacent chambers to reduce cross contamination between the coating components being sputtered onto substrates therein, said sputtering chambers being isolated from ambient atmospheric conditions; means for transporting said plurality of substrates through said means for sputtering at variable velocities; means for reducing the ambient pressure within said means for sputtering to a vacuum level within a pressure range sufficient to enable sputtering operation; means for heating said plurality of substrates to a temperature conducive to sputtering said multi-layer coatings thereon, said means for heating providing a substantially uniform

temperature profile over the surface of said substrate; and control means for providing control signals to and for receiving feedback input from, said means for sputtering, means for transporting, means for reducing and means for heating, said control means being programmable for allowing control over said means for sputtering, means for transporting, means for reducing and means for heating.

A process in accordance the present invention includes: providing substrates to be sputtered; creating an environment about said substrates, said environment having a pressure within a pressure range which would enable sputtering operations; providing a gas into said environment in a plasma state and within said pressure range to carry out sputtering operations; transporting substrates at varying velocities through said environment a sequence of sputtering steps within said environment and along a return path external to said environment simultaneously introducing the substrates into said environment without substantially disrupting said pressure of said environment, providing rapid and uniform heating of said substrates to optimize film integrity during sputtering steps, and sputtering said substrates to provide successive layers of thin films on the substrates; and, removing the sputtered substrates without contaminating said environment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the figures of the drawings wherein like numbers denote like parts throughout and wherein:

Figure 1 is a system plan view of the sputtering apparatus of the present invention.

Figure 2 is a cross sectional view along line 2-2 of the sputtering apparatus of the present invention as shown in Figure 1.

Figure 3 is a plan view of the sputtering apparatus of the present invention illustrating the physical relationship of the power supply and pumping subsystem components.

Figure 4 is an overview block diagram of the sputtering process of the present invention.

Figure 5 is a simplified perspective view of the means for texturing disk substrates used in the process of the present invention.

Figure 6 is a cross sectional view along line 6 - 6 of the cam wheel utilized in the means for texturing shown in Figure 5.

Figure 7 is a sectional magnified view of the texturing of a disk surface provided by the means for texturing disclosed in Figure 5.

Figure 8 is a surface view of one embodiment of a pallet for carrying disks through the sputtering apparatus of the present invention.

Figure 9 is a partial, enlarged view of the pallet of Figure 8.

Figure 10 is a partial, enlarged view of one region for carrying a disk in the pallet of Figure 9.

Figure 11 is a cross sectional view along 11 - 11 of the disk carrying region shown in Figure 10.

Figure 12 is an overview diagram of the pumping system used with the apparatus of the present invention.

Figure 13 is a side, partial cutaway view of a sputtering chamber utilized in the apparatus of the present invention.

Figure 14 is an assembled cross sectional view of the substrate transport mechanism, sputtering

shields, and pallet viewed along line 14 - 14 of Figure 13.

Figure 15 is a cross sectional view of the main (or "dwell") heating lamp assembly and chamber.

Figure 16 is a view of the main heating lamp assembly along line 16 -16 in Figure 15.

Figure 17 is a view of the main heating lamp mounting tray and cooling lines along line 17 - 17 in Figure 15.

Figure 18 is a cross sectional view of the secondary (or "passby") heating lamp and chamber assembly.

Figure 19 is a view of the heating lamp assembly along line 19 - 19 in Figure 18.

Figure 20 is a view of the secondary heating lamp, mounting tray and cooling lines along line 20 - 20 in Figure 18.

Figure 21 is a perspective, partial view of a heat reflecting panel, pallet, and substrate transport system utilized in the apparatus present invention.

Figure 22 is a perspective, exploded view of a portion of a pallet, substrate transport mechanism, sputtering shield, and cathode assembly utilized in the sputtering apparatus of the present invention.

Figure 23 is a top view of the sputtering chamber shown in Figure 13.

Figure 24 is a cross-sectional, side view along line 24 - 24 of Figure 23.

Figure 25 is a partial perspective view of a first surface of the cathode portion of the magnetron of the present invention.

Figure 26 is a perspective view of a second surface of the cathode of the magnetron of the present

invention, including cooling line inputs and magnet channels of the cathode.

Figure 27A is a cross-sectional, assembled view of a first embodiment of the magnet configuration in the cathode for a nonmagnetic target of the present invention along line 27 - 27 of Figure 25.

Figure 27B is a cross-sectional, assembled views of a second embodiment of the magnet configuration in the cathode for magnetic target of the present invention along line 27 - 27 of Figure 25.

Figure 28 is a cross sectional view of the multi-layer sputtered thin film created by the process of the present invention.

Figure 29 is a block diagram of the electronic control system of the present invention.

Figure 30 is a block flow chart of functional aspects of the software utilized in the process controller(s) of the present invention.

Figure 31 is a flow chart of the automated cryogenic pump regeneration process of the present invention.

Figures 32A through 32D comprise a single logical flow diagram outlining the software logic controlling the motor assemblies, load lock and exit lock pumping, and heater power during the automatic substrate run mode of the software utilized in the electronic control system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A. Introduction

Described herein is an apparatus and method for applying multilayer thin films to a substrate. The apparatus of the present invention is capable of applying the multilayer coatings to any given substrate

within a time frame of approximately five minutes. The apparatus and process may provide production throughputs on the order of at least five times greater than those of prior art multi-layer coating processes.

Other advantages of the sputtering apparatus and method for high throughput sputtering include: flexibility with respect to the composition of the multilayer films applied and the types of substrates to which they are applied; easily interchanged coating components; a novel means for heating substrates; a novel sputtering magnetron design; a variable speed, overhead, noncontaminating substrate transportation system; and a comprehensive, centralized, programmable electronic means for controlling the apparatus and process. In addition, when the process and apparatus are used for providing magnetic coatings for substrates, such as disks, to be utilized in hard disk drives using Winchester-type technology, also disclosed herein are: a unique disk texturing method for improving the disk's magnetic recording properties, and a novel disk carrier (or pallet) design which contributes to uniform substrate heating characteristics in a large, single, high capacity pallet.

The high throughput process and apparatus of the present invention accomplishes the objectives of the invention and provides the above advantages by providing a comprehensive in-line sputtering system utilizing matched component elements to process multiple large single sheet or pallet transported discrete substrates in a continuous, variable speed, sputtering process wherein each substrate has a start-to-finish process time which is relatively constant. Such an apparatus and method can process up to 3,000 95mm disk substrates, and 5,300 65mm disk substrates, per hour. In the disk

drive industry where cost savings per disk on the order of a few cents are a distinct advantage, the system manufactures 95mm disk substrates at a cost of $8.00 per disk as opposed to $12.00 per disk for other sputtering apparatus. Crucial to this process and apparatus are matching and optimizing such elements as disk preparation, including texturing and cleaning, provision of a sputtering environment with a sputtering apparatus, through an optimal vacuum pump system, transporting disk substrates through the sputtering environment in a high volume, high speed, contaminant-free manner without disturbing the sputtering environment, heating the substrates within the environment to optimal thermal levels for sputtering, and sputtering the substrates through a series of substantially isolated, non-crosscontaminating sputtering steps.

In general, application of multilayer films to a substrate involves two basic steps: preparation of the substrate and film deposition. Figure 4 represents a general overview of the process for applying thin films to a disk substrate according to the present invention. In particular, Figure 4 outlines the process steps for providing a single or multilayer film on a substrate, for example, a nickel-phosphorus plated aluminum disk for use in Winchester-type hard disk drives. It will be recognized by those skilled in the art that the steps outlined in Figure 4 may be modified, as required, depending on the particular type of substrate to be coated or thin film to be applied.

Substrate preparation process 410 of Figure 4 includes: kitting process 412; disk texturing process 414, disk precleaning 416; water rinse 418; ultrasonic cleaning with caustic cleaner 420; a sponge scrubbing in water 422; an ultrasonic cleaning in hot deionized water

424; scrubbing and deionizing water spray rinse 426; overflow deionized water rinse 428; ultrasonic cleaning of the disks with warm FREON TES 430; a cool FREON TES rinse 432; and vapor displacement drying in warm FREON TES 434. Each of the aforementioned steps outlined in Figure 4 is discussed in further detail in Section C of the specification.

Subsequent to the substrate preparation process 410, the clean, dry disk substrates may be provided to pallet loading process 450, wherein the disk substrates are provided to a substrate carrier which transports the disk substrates through coating process 460.

In coating process 460, disk substrates are provided to a coating apparatus, such as sputtering apparatus 10 shown in Figures 1 and 2, for provision of single or multilayer film thereon. The steps involved in coating process 460, such as in, for example, sputtering apparatus 10 of the present invention, involve: a system evacuation process 472 wherein specific chambers of the sputtering system are evacuated to a pressure of approximately 10^{-7} Torr and backfilled with a suitable sputtering gas, such as argon; a substrate heating process 476, wherein the substrates are raised to a temperature conducive to optimal film deposition; and a sputtering process 478 wherein the films are deposited on the substrates. Subsequently, the substrates are provided to an unload process 480. A process for transporting pallets 474 provides means for transporting the substrates through the above processes.

Each of the aforementioned steps with respect to applying the multilayer films to the substrates is discussed below in detail in separate sections of this specification.

B. Sputtering Apparatus Overview

Sputtering apparatus 10, used to apply a single or multilayer film to one or more substrates, will be discussed generally with reference to Figures 1A, 1B, 2A, 2B, and 3. Sputtering apparatus 10 provides a high throughput, in-line, magnetron sputtering process which allows reduced manufacturing costs per substrate by performing the coating sequence in a high volume manner. As will be discussed in detail below, single or multilayer film can be applied to a single side, or both sides, individually or simultaneously, of a single large sheet substrate, or to discrete substrates, such as disks mounted in a rack, pallet or other substrate carrier.

Generally, substrates are provided through multiple sputtering chambers 20, 26, 28 in apparatus 10 at a rate of speed, such as 3-6 feet/minute, and through heater chambers 14,16 and buffer chambers 12, 18, 22A-E, 24A-24C, 29 and 30, at a second rate of speed, such as 12 feet/minute. Through carefully matched elements, each of the substrates has a constant speed through apparatus 10.

Sputtering apparatus 10 includes seventeen (17) chamber modules 12-30 generally comprised of two basic types. A first type is configured for use as lock modules (12, 30), deposition process modules (20, 26, 28) or dwell modules (14, 18, 22A-22D and 29). A second type of module is configured for use as high vacuum buffer modules (16, 24A-24C) to provide process separation between deposition modules as discussed below.

Also shown in Figures 1 and 2 is substrate carrier return path 50 of the transport system of the present invention. Preferably, return path 50 is provided to

allow an ample number of substrate carriers to return from exit lock 30 for reuse in sputtering apparatus 10 in a continuous process, thereby reducing production delays and increasing overall process production speed. In addition, Figures 1 and 2 illustrate robotic pallet loading station 40 and robotic pallet unloading station 45, arranged along the transport system return path 50, for automatic loading and unloading, respectively, of the disk substrates into racks or pallets. As discussed in detail below, the substrate transport system utilizes a plurality of individual transport beam platforms, each including one or more optical or proximity position sensors, to move substrates through sputtering apparatus 10 and along return path 50, and to monitor the position of each substrate carrier within the transport system. Transfer speeds of the substrate carriers throughout the transport system may be adjustably varied from 0 to 24 ft/min. It should be noted that the upper limit of substrate carrier transport speed is constrained by the process limits of sputtering apparatus 10. Each individual drive stage (2200, discussed in Section F of this specification) is identical and thus has identical upper and lower speed limits.

Twelve (12) pneumatically operated doors D1-D12 are placed between specific chamber modules 12-30 of sputtering apparatus 10. Doors D1-D12 are located as generally represented in Figure 12 and are positioned as follows: door D1 isolates chamber 12 from the ambient environment; door D2 isolates load lock chamber 12 from main ("dwell") heating chamber 14; door D3 isolates main heating chamber 14 from first buffer-passby heating chamber 16; door D4 isolates buffer chamber 16 from first dwell chamber 18; doors D5-D6 isolate second buffer chamber 24A from third dwell

chamber 22B; doors D7-D8 isolate third buffer chamber 24B from fifth dwell chamber 22D; doors D9-D10 isolate fourth buffer chamber 24C from exit buffer 29; door D11 isolates exit buffer chamber 29 from exit lock chamber 30; and door D12 isolates exit lock chamber 30 from the ambient environment.

With reference to Figures 1-3 and 12, the general arrangement of chamber modules 12-30 will be hereinafter discussed. Load lock chamber 12 is essentially an isolation chamber between the ambient environment and chambers 14-29 of sputtering apparatus 10. Load lock chamber 12 is repeatedly evacuated between a pressure of approximately 50 mTorr and vented to ambient atmospheric conditions. Generally, sputtering within apparatus 10 takes place in an evacuated environment and chambers 16-29 are evacuated to the pressure of approximately 10^{-7} Torr, before argon gas is allowed to flow into the chambers to achieve a suitable sputtering pressure. Load lock chamber 12 is constructed of one-inch thick type 304 stainless steel and has a width W_1 of approximately 39 inches, length L_1 of approximately 49 inches, and a depth D_1 of approximately 12 inches as measured at the exterior walls of the chamber. The use of electropolished stainless steel in load lock chamber 12 and all other chambers in apparatus 10 minimizes particulate generation from scratches and other surface imperfections. Chambers 14, 18, 20, 22A-22D, 24A-24C, 26 and 28-30 have roughly the same dimensions. The internal volume of load lock chamber 12 is reduced to approximately three cubic feet by the installation therein of volume-displacing solid aluminum blocks bolted to the chamber door and rear wall (not shown) to facilitate faster evacuation times. Pump-down of load

lock chamber 12, and sputtering apparatus 10 in general, is discussed below in Section F of the specification.

After door D1 is pneumatically operated to allow a single large substrate or pallet to enter load lock chamber 12 at the initiation of processing by sputtering apparatus 10, load lock chamber 12 will be evacuated to a pressure of 50 microns (50 mTorr). Chambers 16-29 will have been evacuated to a base pressure of about 10^{-7} Torr and then backfilled with argon to the sputtering pressure (approximately 9-12 mTorr) prior to the entrance of a substrate into load lock chamber 12. Chamber 14 will have been evacuated previously to a pressure of approximately 10^{-5} - 10^{-7} Torr. Load lock chamber 12 is thus mechanically evacuated and pressurized at a level intermediate to that of chambers 14-29, and external ambient pressures, to provide isolation for the downstream sputtering processes occurring in chambers 14-29.

Dwell heating chamber 14 serves two functions: it acts as an entrance buffer between load lock chamber 12 and the internal sputtering environment in chambers 16-29; and it serves as a heating chamber for increasing the substrate temperature to optimize film deposition. Chamber 14 includes eight banks of quartz lamp heating elements, four banks mounted to outer door 114 and four banks mounted opposite thereof on rear chamber wall 99. Door D2, separating load lock chamber 12 and dwell heating chamber 14, is a high vacuum slit valve. Details of the heating banks located in dwell heating chamber 14 are discussed in Section H of this specification.

During processing of a substrate, dwell heating chamber 14 is pumped to a pressure of approximately

10^{-5} - 10^{-7} Torr before the substrate present in load lock chamber 12 is allowed to pass into dwell heating chamber 14. A pressure of 10^{-5} - 10^{-7} Torr helps eliminate the effects of outgassing from the substrate in dwell heating chamber 14. Subsequently argon backfilling is provided to raise the pressure to approximately 9-12 mTorr, equalizing the environment in dwell heating chamber 14 with that in chambers 16-29. The substrate may thereafter remain in dwell heating chamber 14 for the duration of time necessary for the exposure of the substrate to the lamps to have its desired effect.

First buffer-passby heating chamber 16 is a chamber module of the second type having a width W_2 of approximately 26 inches by a height H' of approximately 49 inches by a depth D' of approximately 12 inches. In general, buffer chambers 16 and 24A-C are positioned between dwell chambers 18A and 22A-D to separate the ongoing sputtering processes within apparatus 10, thereby reducing cross-contamination of coating components.

First buffer-passby heating chamber 16 includes a heating assembly comprising ten banks of quartz lamp heating elements, five mounted to outer door 116 and five to the rear chamber 100 wall opposite thereof. Passby heating chamber 16 is designed to insure uniform substrate temperature prior to film deposition. The structure of the passby heating assembly is discussed in detail in Section H of this specification.

Three coating modules -- chromium deposition chamber 20, magnetic deposition chamber 26, and carbon deposition chamber 28 -- having dimensions roughly equal to those of load lock chamber 12 and constructed of type 304 electropolished stainless steel, may be utilized to sputter single or multilayer films on a substrate

passing through apparatus 10. Four pairs of d. c. magnetron sputtering cathodes are mounted, four magnetrons per door, on doors 120-1, 120-2, 126-1, 126-2, 128-1, and 128-2 on both sides of each chamber 20, 26, and 28, respectively. Target materials are mounted to cathodes 2222-2225. Anodes 2338, gas manifolds 2323, and shielding 2230, 2236, 2238 and 2240 are also attached to outer doors 120-1, 120-2, 126-1, 126-2 and 128-1, 128-2. Mounting these components to the doors facilitates target changes and chamber maintenance. Further, conduits (not shown) for power, cooling, and process gases are provided in outer doors 120, 126, 128. Feedthrough conduits are also provided in doors 112, 114, 116, 118, 122A-122E, 124A-124C, 129, and 130 to allow for modification of the sputtering apparatus 10. Details of deposition chambers 20, 26 and 28 are provided in Section I of this specification.

Dwell chambers 18 and 22A-22E are manufactured to have the same dimensions as load lock chamber 12 and provide separation between the buffer modules and the deposition chambers. Dwell modules 18 and 22A-22E allow for substrate transport system runout, if necessary, during multiple substrate processing in sputtering apparatus 10. If desired, additional heating assemblies may be provided in any or all of dwell modules 22A-22E.

Exit buffer module 29 is essentially identical to dwell heating chamber 14, without the dwell heating assembly hardware. Exit buffer module 29 provides a buffer area to facilitate removal of pallets or substrates from sputtering apparatus 10 to exit lock chamber 30 and further isolates the sputtering process from the external environment.

Exit lock chamber 30 is essentially identical to load lock chamber 12 and operates in reverse pumping

order, allowing pallets or substrates to be transferred from the evacuated environment of sputtering apparatus 10, to the ambient external environment.

Optimally, sputtering apparatus 10 can simultaneously process up to seven large single sheet substrates or pallets carrying smaller substrates, such as disks. When seven such substrates are simultaneously processed in sputtering apparatus 10, one such substrate is positioned in each of seven chambers, for example, as follows: load lock chamber 12; dwell heating chamber 14; chromium deposition chamber 20; magnetic deposition chamber 26; carbon deposition chamber 28; exit buffer chamber 29; and exit lock chamber 30. The sheer dimensions of sputtering apparatus 10 allow for a plurality of large single sheet substrates, and a plurality of high capacity discrete substrate carrying pallets, or both, to be simultaneously processed. The problems attending the development of such a large scale, high throughput sputtering apparatus, and the solutions adopted, are discussed herein.

Chambers 12-30 are mounted on steel assembly rack 150. Rack 150 includes channels 55 which preferably are used to mount components used with sputtering apparatus 10, such as those used in the electronic control system. It will be understood by those skilled in the art that any suitable arrangement for mounting chambers 12-30 may be made within contemplation of the present invention.

C. <u>Substrate Preparation</u>

Various materials in the form of large single sheet or discrete substrates may be coated in sputtering apparatus 10. Suitable substrates include polished nickel-phosphorus plated aluminum disks, ceramic disks (available from Kyocera Industrial Ceramics Corporation,

Los Angeles, California, or Corning Glass Corporation, Corning, New York), glass substrates (available from Pilkington Corporation Microelectronics, Ltd., Toledo, Ohio, Nederlandse Philips Bedrijven B.V., The Netherlands, or Glaverbel Corporation Data Storage Glass Products, Belgium), or carbon substrates or graphite substrates (Kao Corporation of Japan). The process and apparatus disclosed herein is discussed with regard to preparation and sputtering of polished nickel-phosphorus plated aluminum substrates, such as disks suitable for use in Winchester-type hard disk drives. As will be understood by those skilled in the art, the system is readily adaptable for use with other types of single sheet or discrete substrates as discussed above.

1. Kitting

In general, polished nickel-phosphorus plated aluminum disks or similar substrates utilized in the manufacture of magnetic recording media for Winchester-type hard disk drives, such as those available from Mitsubishi Corporation or Seagate Corporation, are shipped to magnetic media manufacturers in standard ribbed or slotted shipping cassettes, 25 substrates per cassette. Transfer of the substrates from the shipping cassettes to process cassettes, used in processing the disks through texturing process 414 and up through pre-cleaning process 416, is known as kitting. Kitting must occur in a class 10,000 clean room environment and is generally performed manually.

2. Texturing

It is well known in the art that circumferential texturing or abrading of a substrate surface can cause the hcp "C" axis of a magnetic cobalt-alloy film to

orient in a circumferential direction, and thereby supply a more intense and uniform read/back signal to a flying read/write head in a Winchester-type hard disk drive. Texturing the disk substrate also affects the glide properties of the read/write read. Obviously, the texture of the disk surface also provides a limit to the minimum flying height of the read/write head. Texturing of the substrate also prevents stiction which may result should the head land on a smooth, planar area of the disk, thereby resulting in a job-blocking effect, rendering it almost impossible to remove the stuck read/write head from the disk surface, and rendering a disk drive entirely inoperable.

Texturing generally takes place in a class 1,000 clean room and, as previously discussed, any number of well-known methods may be used.

In the preparation of substrates to be coated within sputtering apparatus 10, a plurality of texturing machines, such as Exclusive Design Company's EDC Model C texturing machine, (EDC, 914 South Clairmont, San Mateo, California 94402) are used. A novel modification to each EDC texturing machine provides a unique, diamond-shaped texturing effect. A portion of a disk surface having such texturing is illustrated in Figure 7.

With reference to Figures 5 through 7, texturing process 414 will be hereinafter described in relation to the texturing of discrete disk substrates 510 suitable for use in sputtering apparatus 10.

Figure 5 is a general disclosure of the texturing portion 500 of texturing machine M.

Generally, texturing of disk substrate 510 is performed using two loops of fixed abrasive tape 515 which are stretched about rubber rollers 520-1, 520-2.

Abrasive tape 515 for each roller 520 is provided by two reels, one supply reel and one take-up reel (not shown), in a single feed direction with a portion of abrasive tape 515 looped about rollers 520. Abrasive tape 515 makes only one transition from the supply reel to the take-up reel during a normal texturing cycle. Rollers 520-1 and 520-2 rotate about spindles 522-1 and 522-2, respectively, mounted to oscillation arm 525 of machine M.

A second set of rubber rollers 530-1, 530-2, and associated supply and take-up reels, (not shown), allow for mounting a fine cloth tape 535 to remove excess particulate matter generated by abrasive tape 515 as disk 510 is texturized. Like abrasive tape 515, cloth tape 535 is used only once from supply reel to take-up reel.

Cam assembly 550 causes arm 525, rollers 520-1, 520-2, and abrasive tape 515 to oscillate in the direction of axis X. Cam assembly 550 includes cam wheel 600 fixed by two set screws (not shown) to spindle 560 which is rotated in a counterclockwise direction about axis Y_1 by machine M. Cam wheel 600 contacts first and second rollers 570, 575, rotatably mounted to support members 572, 574, respectively, to translate the motion defined by rotation of cam wheels 600 to oscillation arm 525.

In operation, disk substrate 510 is mounted on spindle 540 of machine M and rotated in a clockwise direction about axis Y_2 passing through the center of spindle 540. To mount a disk substrate 510, machine M causes rollers 520 and 530 to linearly separate in opposing directions along paths parallel axes Y_{1-2} allowing disk substrate 510 to be inserted and removed by an automatic loading apparatus (not shown) onto spindle 540. Disk substrate 510 is then rotated about

axis Y_2 in a clockwise direction. Simultaneously thereto, abrasive tape 515 and cloth tape 535 are rotated about rollers 520-1, 520-2 and 530-1, 530-2, respectively, such that rollers 520-2 and roller 530-1 rotate in a clockwise direction, and rollers 520-1 and 530-2 rotate in a counterclockwise direction. Thus, opposing rollers 520-1, 520-2 and 530-1, 530-2 rotate in directions opposite to each other and in a direction opposing the direction of rotation of disk substrate 510, to provide optimal disk texturing and cleaning. As rollers 520 and 530 are rotated, machine M simultaneously rotates spindle 560, and hence cam wheel 600, causing rollers 520 to oscillate about axis X.

As a result of the unique shape cam wheel 600, discussed with reference with Figures 6A-6B, a novel cross-hatched type texturing 700 results. With reference to Figure 7, texturing process 414, discussed above, generally forms diamond-shaped areas 750 defined by a plurality of crossing texture lines 740 provided to a depth of 60 μm. When lines 740 intersect, they define a plurality of angles θ in a range of approximately 6 to 10 degrees. It has been determined that an angle greater than 10 degrees, while providing generally excellent properties of low dynamic friction and low stiction, results in problems with the magnetic recording properties such as bit dropouts or shifts in areas adjacent to intersecting texturing lines. To compensate, a higher coercivity alloy is required on the substrate. These problems are within acceptable levels when angle θ is within a range of 4°-10°. An angle of 6 degrees or less improves the magnetic recording capability of the record media, but sacrifices in stiction and running friction properties of the disk are made for θ less than 6 degrees. Preferably, when

rotation Y_1 of cam wheel 600 is approximately 6 Hertz, angles θ of approximately 6° will result.

The structure of cam wheel 600 is detailed in Figure 6A and 6B. Figure 6A shows cross-section cam wheel 600 along line 6-6 in Figure 5. Cam wheel 600 has a shape wherein the radial distance R between axis Y_1 and outer edge 710 is at a minimum distance R1 at reference point 720, and at a maximum distance R2 at point 730, 180° opposite point 720.

Currently, two types of cams are used in the machine M for texturing disk substrates 510, depending on the size of disk substrate 510. In one embodiment, the distance R2 equals one inch and distance R1 = .760 inch. Figure 6B illustrates the distance of all points along outer edge 710 from axis Y_1. As can be seen therein, radial distance R from outer diameter 710 to axis Y1 is evenly sloped from the point 720 to point 730, of 180° opposite from point 720. Assuming a line from axis Y_1 to point 720 is used as a reference, the distance of all points along outer edge 710 from axis Y_1 in one embodiment is as follows: the distance R1 at point 720 = .756 inch, the distance at 60° and 300° angles from point 720 = .840 inch, the distance at 120° and 240° from point 720 = .920 inch, and the distance R2 at 180° from point 720 (point 730) = 1.00 inches.

In the above embodiment, cam wheel 600 may be manufactured by beginning with a completely circular cam wheel and removing outer edge 720 of cam wheel 600 in equal linear to rotational increments. For example, at point 730, no material is removed, moving 3 degrees to the left or right, the cutting device is adjusted to move in a distance toward axis Y_1 of approximately .004 inch, and is thereafter moved .004 inch closer to axis Y_1 for every 3° of rotational movement about axis

Y_1. In this manner, one embodiment of cam wheel 600 may be manufactured; those skilled in the art will recognize that various sizes and types of cam wheels may be manufactured in like manner for various sizes of disk substrates 510.

3. Disk Cleaning

Following texturing, the disk surface is cleaned to facilitate uniform film deposition, for example, by performing the following steps, represented as stage 416 in Figure 4.

During precleaning process 416, each disk surface is rubbed with a polyurethane soap pad. In an automated process, textured disk substrates are removed from process cassettes and placed in a precleaning machine such as the Model MDS1, commercially available from Speed Fam Corporation of Tempe, Arizona. In the Speed Fam machine described above, a plurality of disk substrates is arranged about a large pad assembly in a cylindrical tank, thereby allowing rapid disk cleaning (up to 350 95-mm disks per hour) by performing precleaning process 416 on a number of disk substrates simultaneously.

An additional preparation step involves taking disk substrates through a multi-staged cleaning process 435. This process is illustrated generally in Figure 4 as stages 418 through 434. Each stage, for example, may represent a separate tank process wherein all tanks are connected with a conveyor system. In addition, transfer between individual stages may be performed by robots.

Specifically, disk substrates 510 are rinsed in water at stage 418, followed by several ultrasonic cleaning stages (420, 424 and 430) and sponge scrubbing stages (422 and 426). The multistage cleaning process

435 processing stages include water rinse 418; ultrasonic cleaning with caustic cleaner 420; a sponge scrubbing in water 422; an ultrasonic cleaning in hot deionized water 424; ultrafiltered deionized water spray rinse 426; overflow deionized water rinse 428; ultrasonic cleaning of disk substrates with warm FREON TES 430; a cool FREON TES rinse 432; and vapor displacement drying in warm FREON TES 434.

Application of ultrasonic power is particularly useful in scouring the newly-applied fine cross-texturing grooves on the disk surface. Stages 420, 424 and 426 combine ultrasonic action in liquids with alkali and aqueous cleaning agents for thorough cleaning. Stage 430 combines ultrasonic action with a degreasing solvent like DuPont's FREON TES.

Multistage cleaning process 435 is preferably performed by a Speed Fam Model MD08 cleaning machine. The Speed Fam model MD08 with certain modifications, is suitable for performing this final cleaning process, to maintain the high level of substrate cleanliness prior to film deposition. Specifically, modifications to the Speed Fam MD08 machine include passivated stainless steel tanks and recirculation lines, brush materials such as polyvinylalcohol, and a highly efficient tank filtration system. In addition, standard process cassette rollers are replaced with highly wear-resistant plastics like DuPont's DELRIN polymethylene oxide. The process regimen 410, as illustrated by Figure 4, was found to be capable of handling approximately 550-750 disks per hour, using two Speed Fam model MDS1 polishing machines and one Speed Fam model MD08 cleaning machine. Higher processing rates would result with additional process hardware, but may be limited because of the

release of FREON TES, a chlorinated fluorocarbon, to the environment.

D. Pallet Design

A unique rack or "pallet" for carrying a number of discrete substrates such as disks utilized in Winchester-type hard disk technology will be discussed with reference to Figures 8-11.

Generally, a plurality of magnetic disk sizes are manufactured for Winchester-type hard disk drives; two of the most common include 65 mm and 95 mm diameter disks. It will be understood that the general principles of pallet 800, described herein with reference to a pallet for carrying 95 mm disks, are applicable for pallets equally capable of handling disk substrates of other sizes.

Pallet 800, shown in Figure 8, shows 56 substrate carrying regions 1000 for carrying 95 mm diameter disk substrates 510. A pallet designed to carry 65 mm diameter disk substrates has 99 substrate-carrying regions 1000. Pallet 800 may be manufactured from 6061-T6 aluminum, available from the Aluminum Corporation of America (Alcoa), Pittsburg, Pennsylvania or other suitable material. Pallet 800 has a height H'' of approximately 34.56 inches, a length L of approximately 31 inches, and a depth DD of approximately 0.25 inch. These dimensions reflect the maximum size pallets or single sheet substrates which may be utilized if sputtering apparatus 10 is made to have dimensions as discussed herein.

In utilizing pallets having the above-mentioned dimensions, several problems arise. Achieving a uniform temperature profile across the surface of the pallet is difficult, especially where thermal expansion of the

pallet material occurs at a different rate than that of disk substrates carried therein because of the pallet's greater thickness. Specifically, thermal expansion of the pallet material causes inherent warping of the pallet. Further, thermal expansion reduces the clearance within each substrate-carrying region 1000 around each disk substrate 510, constricting and warping disk substrates 510 undergoing their own thermal expansion, and ultimately precluding uniform film deposition. Addressing thermal expansion incompatibilities between the pallet and disk substrates is more than an issue of material selection. For a high throughput sputtering system, maximizing the substrate-carrying capacity of pallet 800 is equally desirable.

To minimize warping while maximizing the substrate-carrying capacity of pallet 800, substrate-carrying regions 1000 are arranged in a staggered, hexagonal fashion, providing the densest arrangement of disk substrates 510 within the established dimensions of pallet 800. As such, substrate-carrying regions 1000 are arranged in rows 810-880, wherein each substrate-carrying region 1000 in a particular row (e.g., 810) is offset from another substrate-carrying region 1000 in an adjacent row (e.g., 820) by a distance equalling one-half of the total horizontal width of each substrate-carrying region 1000.

In an effort to minimize thermal losses from disk substrates 510 to pallet 800, slots 890 and cavities 895 are provided. Cavities 895 in the lower portion of pallet 800 reduce the surface area of pallet 800 which is subject to thermal expansion, without reducing the substrate-carrying capacity of pallet 800 as the lower portion of pallet 800 does not carry disks beyond the extent of the sputtering flux. Notches 892 compensate

for nonuniform thermal expansion across pallet 800 as a result of nonuniform heating across the pallet surface. Specifically, notches 892 allow relatively unrestricted expansion of the edges of pallet 800, thereby avoiding pallet warping.

Reference notches 910 in pallet 800 are provided for use with robotic loading and unloading stations 40 and 45. Specific operation of these stations 40 and 45 is discussed in Section E of the specification.

With reference to Figures 10 and 11, details of disk substrate-carrying regions 1000 are hereinafter discussed. Each substrate-carrying region 1000 has a roughly circular orifice with an outer circumferential edge 1010 defined by a beveled edge 1015. Beveled edge 1015 reduces any shielding effect pallet 800 may have on disk substrate 510 mounted in substrate-carrying region 1000 during sputtering. Notch mounting groove 1020 in the lower half of region 1000 allows disk substrate 510 to be seated therein. Lip 1030, at the upper portion of substrate-carrying region 1000, allows manual insertion of disk substrates 510 into substrate-carrying regions 1000. As shown in Figure 10, lip 1030 defines a semi-circular arc 1035 having a radial distance from axis F of 1.9 inches in the 95 mm embodiment of pallet 800, shown in Figures 8-11. Inner edge 1040 is defined by one end of beveled edge 1015 and has a radial distance from axis G of approximately 1.859 inches. Groove 1020 likewise has a semi-circular shape and is positioned a radial distance of 1.883 inches from axis G. Groove 1020 has a depth D' of approximately .012 inches.

In practice, disk substrate 510 is seated in groove 1020 and is securely held in place therein. During processing, pallet 800 is relatively stable and disk substrate 510 is securely maintained in substrate-

carrying region 1000. The radial distance between axis F and axis G is approximately 0.12 inch, and thus the radial distance between lip region arc 1035 and the base of groove 1020 is 3.903 inches, a distance which is greater than the diameter of a 95 mm disk (3.743 inches). This excess space facilitates disk loading and allows for thermal expansion of disk substrate 510 relative to the pallet 800 during the heating process.

It should be noted that pallet 800 may be passed through sputtering apparatus 10 many times before cleaning, especially of grooves 1020, is required to insure substrate-carrying security within substrate-carrying regions 1000. After approximately 100 production cycles, edge 1040 and groove 1020 must be cleaned due to buildup of deposited layers from constant sputtering in sputtering apparatus 10.

E. <u>Substrate Loading</u>

As discussed briefly with reference to Figure 1, disk substrates 510 may be provided in pallet 800 by means of an automatic loading process which preferably occurs at a point along transport system return path 50. Robotic loading station 40 is arranged to load disk substrates 510 into pallets 800 just prior to entrance of pallets 800 into load lock chamber 12. Robotic unloading station 45 is preferably positioned to remove disk substrates 510 from pallets 800 just after exit of pallets 800 from exit lock chamber 30.

In the automatic loading/unloading process of the present invention, an automatic pallet loading station 40 and an unloading pallet station 45 built by Intelmatic Corporation of Fremont, California are utilized. Each station uses three Adept Model One robots, controlled by Adept Model CC Compact Controllers

and an Elmo Controller operating under conventional control software, tailored for apparatus 10 by Intelmatic Corporation software for controlling the loading processing and sequencing pallet movement. Three robots 40-1, 40-2, 40-3 load pallets 800 in a top to bottom manner, with first robot 40-1 loading the top third of pallet 800, second robot 40-2 loading the middle third of pallet 800 and a third robot 40-3 loading the bottom third of pallet 800. Likewise, three robots 45-1, 45-2, 45-3 unload substrates from pallet 800 in a reverse order to that of robots 40-1, 40-2, 40-3. Specifically, robot 45-1 unloads the bottom third of pallet 800, robot 45-2 then unloads the middle portion of pallet 800 and finally robot 45-3 unloads the top third of pallet 800. Loading and unloading of pallets 800 in this manner ensures that no particulate matter present on pallet 800 or disk substrates 510 falls from the upper portion of pallet 800 to deposit on disk substrates 510 loaded in lower portions of pallet 800 during the loading or unloading process.

The Adept Model One robot and Intelmatic software utilize reference notches 910 in pallet 800 to locate the approximate center of each substrate-carrying region 1000. The Adept robots utilize a single finger-type loading mechanism which engages disk substrates 510 by protruding through the center of each disk substrate 510 and lifts and places disk substrates 510 into grooves 1020 within each substrate-carrying region 1000.

Automatic robots 40-1, 40-2, 40-3 and robots 45-1, 45-2, 45-3 in conjunction with the Intelmatic system, have the capability of loading and unloading, respectively, up to 2,500 disk substrates per hour. Sputtering apparatus 10 has a capability of producing 3,000 95mm thin magnetic film coated disks per hour.

Automatic loading and unloading stations 40, 45 thus represent constraints on production throughput for the present embodiment of the overall sputtering process discussed herein. As will be recognized by those skilled in the art, additional stations may be provided to increase production loading to match apparatus 10 throughput rates.

Pallet 800 may also be manually loaded and unloaded. In manual loading, lip 1030 is used to align the surface of disk substrate 510 with the planar surface of pallet 800 to more accurately provide disk 510 substrate into groove 1020.

F. Pumping System

Sputtering apparatus 10 incorporates a highly efficient, high capacity vacuum pump system, represented schematically in Figure 12. Preparing sputtering apparatus 10 to carry out the sputtering operation described by the present invention requires that the vacuum pump system achieve two purposes. First, the vacuum pump system must furnish a highly evacuated environment for substantially unobstructed paths between the bombarding species and the target surface, and between dislodged target species and the substrates. Second, the vacuum pump system must minimize contaminant circulation inside sputtering apparatus 10 in order to maintain high film integrity. These goals are achieved simultaneously by virtue of the design of the pumping system of the present invention.

The overall vacuum pump system comprises three mechanical or roughing pumps MP1-MP3, with blowers BL1-BL3, and twelve (12) cryo pumps, C1-C12 including seven 8-inch diameter pumps (C3, C4, C6, C7, C9, C10, and C12), four 10-inch diameter cryo pumps (C2, C5, C8, and

C11) for process isolation, and one 16-inch diameter cryo pump C1. A cryo pump model such as is available from CTI Cryogenics, a division of Helix Corporation of Santa Clara, California, is suitable for use in the pumping system of the present inventions. Eight compressors CY1-CY8 provide helium gas to cryo pumps C1-C12, with: CY1 supplying C1; CY2 supplying C2; CY3 supplying C3; CY4 supplying C5; CY5 supplying C4, C6 and C7; CY6 supplying C8; CY7 supplying C9, C10 and C12; and CY8 supplying C11.

The overall vacuum system also features a network of valves. Five chamber vent valves CV1-CV5 vent the internal environment of sputtering apparatus 10 to atmosphere. Roughing valves RV1-RV5 isolate mechanical pumps MP1-MP3 and blowers BL1-BL3 from sputtering apparatus 10. Chamber vent valves CV1-CV5 and roughing valves RV1-RV5 allow the apparatus 10 to be divided into five sections allowing each individual section to be vented and pumped down as desired, to facilitate maintenance of sputtering apparatus 10. (See Section K, <u>System Control Software</u>.) High vacuum valves HV1-HV12 isolate cryo pumps C1-C3 from apparatus 10 to allow controlled pump-down sputtering apparatus 10 from atmospheric pressure. Valves MP1IV-MP3IV isolate one or more of mechanical pumps MP1-MP3 from the pumping system conduits, allowing flexibility in the number of mechanical pumps operating at a given time. Cryo pump roughing valves CR1-CR12 control contamination out of cryo pumps C1-C12 during a cryopump regeneration.

In operation, mechanical pumps MP1-MP3 and blowers BL1-BL3 perform a pump-down of sputtering apparatus 10 from atmospheric pressure to a level of about 50 mTorr. During the pump-down, high vacuum valves HV1 through HV12 are closed, roughing valves RV1 through RV5 and

chamber isolation doors D2 through D11 are open and doors D1 and D12 are closed. Pumps MP1-MP3 and blowers BL1-BL3 evacuate sputtering apparatus 10 to a "crossover" point, which has been selected to be between about 50 microns to 150 microns (50 mTorr to 150 mTorr). When the internal pressure reaches the desired crossover point, the system operator, through the electronic control system, closes roughing valves RV1-RV5 and opens high vacuum valves HV1-HV12. Cryo pumps C1-C12, working in conjunction with compressors CY1-CY8, evacuate the system to about 10^{-5} to 10^{-8} Torr (0.01 microns to 1×10^{-5} microns). Argon gas flow is thereafter provided through gas manifolds 2323 into chambers 14-29 to a sputtering pressure about 9-12 mTorr (9-12 microns).

When a pallet 800 loaded with disk substrates 510 is ready to proceed into sputtering apparatus 10 through load lock chamber 12, chamber 12 is at atmospheric pressure, and chambers 14 through 29 are at about 10 mTorr (10 microns). Pallet 800 enters from a class 10,000 clean room environment where robotic loading station 40 is positioned. Because the clean room environment is more sterile than that of load lock chamber 12, nitrogen gas is provided through valve LLSWEEP and a vent valve (not shown) in load lock 30 is opened to create a positive outflow from the clean room into load lock chamber 12, prohibiting contaminants from entering the clean room's environment. Ceramic filters are also provided to trap particulate matter generated when nitrogen backfill is provided through LLSWEEP into load lock chamber 12. Sturdy filters, such as Membralox 0.01 micron sintered alumina filters, available from Aluminum Company of America (Alcoa) Separations Technology, Warrendale, Pennsylvania, resist flexing over many pumping cycles even at pressures higher than

2000 psi and thereby contribute to the maintenance of a contaminant-free environment within the sputtering apparatus.

After pallet 800 enters load lock chamber 12 and door D1 closes, mechanical pump MP2 and blower BL3 evacuate the load lock chamber 12 down to about 100 mTorr (100 microns). When the crossover point is reached, D2 opens, allowing pallet 800 to proceed into dwell heating chamber 14 where pallet 800 and disk substrates 510 will be preheated in preparation for film deposition. During the heating cycle, some outgassing from pallet 800 and disk substrates 510 occurs, particularly if pallet 800 has been recycled, i.e., has passed through sputtering apparatus 10 at least once without undergoing scheduled cleaning. The carbon remaining on pallet 800 acts as a sponge for water which may be absorbed from the atmosphere when pallet 800 is at any point along return path 50 from a previous sputtering run. Water outgassed (known as 'drag in') in dwell heating chamber 14 is removed from the internal environment of sputtering apparatus 10 by 16-inch cryo pump C1, evacuating dwell heating chamber 14 back down to about 10^{-5} Torr (0.01 microns). At this time, a pressure differential on the order of 10 microns (10 mTorr) exists between dwell heating chamber 14 and passby heating chamber 16. Because such a pressure differential can destabilize downstream sputtering processes, argon is used to backfill dwell heating chamber 14 in order to equalize the pressures, as monitored by Pirani gauge PIR2. Once this pressure differential is equalized, door D3 opens, permitting pallet 800 and disk substrates 510 to proceed into dwell chamber 18. A pump, such as model PFC-1000 from Polycold Systems of San Rafael, California, connected

into dwell chamber 18, removes any residual water outgassed from pallet 800 and disk substrates 510, following additional heating performed in passby heating chamber 16. Removal of this residual water is crucial to eliminate oxidation of the chromium target and underlayer in chromium sputtering chamber 20. Pallet 800 and disk substrates 510 continue through sputtering apparatus 10 and the sputtering operation proceeds as described in Section L.

After the multilayer film is deposited, pallet 800 and disk substrates 510 approach exit lock chamber 30 from exit buffer chamber 29. A pressure differential exists between chambers 29 and 30, on the order of that described in connection with dwell heating chamber 14 and passby heating chamber 16. Argon is used to backfill exit buffer chamber 29 to equalize pressures across door D11, as monitored by Pirani gauge PIR15. Once equalization is accomplished, door D11 opens, allowing pallet 800 with disk substrates 510 to proceed through exit lock chamber 30 and out of sputtering apparatus 10.

Periodically, cryo pumps C1-C12 must be cleaned in order to regenerate the cryogenic capacity of the pumps. More specifically, such cleaning involves clearing the cryo pumps of gases frozen therein. For sputtering apparatus 10, cryo pump regeneration typically takes place during machine down-time scheduled for replacing targets in sputtering chambers 20, 26 and 28.

The cryo pump regeneration process of the present invention is discussed more particularly in Section K of this specification. Generally, cryo pump regeneration is initiated by first closing off all of high vacuum pump valves HV1-HV12, opening roughing sieve valves SVIV1-SVI15 and turning on sieve heaters SVNTR1-SVNTR12,

mechanical pumps MP1-MP3 and blowers BL1-BL3. Simultaneously, warm nitrogen (N_2) is fed from supply N_2 through valves NIF1-NIF12 via heaters NIH1-NIH12 to cryo pumps C1-C12. The nitrogen flow defrosts frozen gases in pumps C1-C12 when C1-C12 reach 290°K, pump MP2 and blower BL2 discharge the contents to the atmosphere external to sputtering apparatus 10. Sieve traps SVIV1-SVIV12 and cryo roughing valves CR1-CR12 insure vapors from hydrocarbon pump oils used in the mechanical pumps do not backflow into and contaminate the internal sputtering environment during the regeneration process. By these means, disk substrates 510 already at various stages within the sputtering apparatus are protected from ambient contaminants accompanying subsequent pallets which enter the sputtering apparatus.

G. Transport Mechanism

With reference to Figures 1, 13, 14, and 24, a system for transporting substrates through sputtering apparatus 10 and along return path 50 utilized in the apparatus and process of the present invention, will be hereinafter described.

The transport system of the present invention utilizes a plurality of individually powered transport platforms 2400. Each transport platform 2400 may be individually controlled with respect to motion and speed by controlling a motor assembly (not shown) associated with each platform. Hence, at any given time, only those motor assemblies associated with platforms which are transporting substrates along their lengths at any given time need be powered. Additionally, the transport speed of each individual platform 2400 is user-controlled, with transfer speeds generally selectable within a specific range, allowing substrate transport

within sputtering apparatus 10 and return path 50 at varying rates. Each transport platform 2400 is provided with one or more proximity sensors (not shown) which output pallet position signals to the electronic control system of the present invention. This allows the electronic control system and the system operator to identify the location of each and every substrate in sputtering apparatus 10 and along return path 50 at any given time. Three such proximity sensors per transport platform 2400 are provided for each of the 19 platforms used in conjunction with sputtering apparatus 10: 17 platforms in chamber modules 12-30 and two additional platforms at entrance platform 210, at the entrance to load lock chamber 12, and exit platform 220, outside exit lock chamber 30. Twenty (20) transport platforms 2400 are provided along return path 50, each such platform stage along return path 50 having one proximity sensor per platform.

With reference to Figures 13, 14, and 24, each transport platform 2400 includes a motor assembly (not shown) coupled to timing chain assembly 1405, including chains 1410 and 1412, and sprocket wheels 1414-1422, mounted on transport beam 1400. An identical timing chain assembly 1405 is located on the opposite side of each transport platform 2400 (as shown in Figure 14).

Generally, sprocket wheels 1421 and 1422 have a single set of teeth and are mounted to beam 1400 to provide tension adjustment for timing chains 1410 and 1412, respectively. Wheel 1416 has a double set of teeth, one set engaging timing chain 1410 and one set engaging timing chain 1412. Timing chains 1410 and 1412 may be manufactured from polyurethane; however, in load lock chamber 12 and exit lock chamber 30, stainless steel timing chains are required due to reduce excessive

particulate matter generated and circulated during repetitive pump-down and venting cycles when using polyurethane timing chains. Alternatively, stainless steel chains may be utilized throughout the system.

Sprocket wheels 1414 and 1418 may have single or double sets of teeth, as needed. Wheels 1414, 1416 and 1418 are coupled to spindles 1430, passing through beam 1400, which are in turn coupled to rubber roller wheels 1435 in cavity 1440 of beam 1400. Sprocket wheel 1420-1 is coupled to a spindle 1424 passing through beam 1400 into cavity 1440 to translate the motion of sprocket wheel 1420-1 to sprocket wheels 1420-2 located on the opposite side of transport platform 2400. Wheels 1420 generally have two sets of teeth, one set engaging timing chain 1412, the other set engaging a chain or gear assembly coupled to the motor assembly associated with the particular transport platform for powering timing chain assemblies 1405. Through bores 1425 are provided in beam 1400 adjacent to the upper portion of each transport beam 1400 to allow sprocket wheels 1420 to be positioned at any of three points along transport platform 2400 as the positioning of the motor assembly relative to transport platform 2400 requires.

It should be noted that the distance between wheels 1414 and 1416, and the distance between wheels 1416 and 1418, is equal. Further, when assembled into a complete transport system encompassing, for example, both apparatus 10 and return path 50, the distance between respective end wheels 1414 and 1418 on adjacent platforms is equal to the distance from wheels 1414 and 1418 to wheels 1416. Thus, the inter-roller spacing of rubber wheels 1435 is equal through the entire transport system.

Substrate carrier 1450 is receivable in interior cavity 1440 of transport beam 1400. Substrate carrier 1450 includes E-beam assembly 1452 and substrate mounting member 1454. E-beam assembly 1452 enters cavity 1440 seated atop rubber wheels 1435 and is transported along the path of each platform 2400 when the individual motor assembly for that platform drives gears 1420 into motion. Guide wheels 1445 are provided to ensure alignment of substrate carrier 1450, and especially E-beam assembly 1452, within cavity 1440.

Each transport platform 2400 is mounted to a wall portion 1402 of sputtering apparatus 10 by a cross beam 1404 and hex nuts 1406. Dual insulating members 1460 isolate substrate carrier 1450, and individual transport platforms 2400, from thermal and electrical energy which is transferred to pallet 800 during transport through sputtering apparatus 10. Insulating members 1460 may be manufactured from an insulating material such as DuPont's DELRIN thermoplastic elastomer. Insulating members 1460 are preferably bolted to substrate mounting member 1454 and include a T-shaped mounting pin 1470 for securing pallet 800. Apertures 805 are provided on extensions 807 of pallet 800 to allow pins 1470 to pass therethrough and pallet 800 to be mounted on carrier 1450.

Maintaining a contaminant-free environment within sputtering apparatus 10 is crucial to quality control in the provision of multi-layer coatings on substrates. Utilization of an overhead drive transport system in the system of the present invention allows a large variety of substrates to be coated within a single apparatus. However, such overhead systems suffer from excessive particulate generation which may fall from the transport system to contaminate disk substrates carried below.

The transport system of the present invention is provided with unique shielding to prevent particulate contaminants generated by the overhead transport drive system from entering chamber modules 12-30 of sputtering apparatus 10. As shown specifically in Figure 14, contaminant shields 1480 are bolted on the lower portion of transport platform 2400 in the interior of chamber modules 12-30. Shields 1480 are shaped so as to bar particulate contaminants generated by each transport platform 2400 from the interior of chamber modules 12-30. In addition, E-beam assembly 1452 is specifically designed such that ends 1482 of shields 1480 are interposed in grooves 1453 of E-beam assembly 1452, minimizing entry of particulate matter into the interior of chambers 12-30.

The transport system described herein further minimizes particulate generation by eliminating metal-to-metal contact. This particular feature of the transport system provides excellent electrical isolation of the substrate, thus providing the added advantage of allowing the substrate to be biased during, for example, carbon sputtering in chamber 28, thereby improving the quality of the carbon coating deposited.

Each individual transport platform 2400 can move substrate carrier 1450 at a velocity ranging up to 24 ft/min along the entire transport path. Optimally, transport speeds within chambers 12-30 of sputtering apparatus 10 are adjustable up to 24 ft/min. Adjustment of drive speeds and each transfer platform 2400 is controlled by the electronic control system as discussed in Section K of this specification.

H. Substrate Heating System

Uniform substrate temperature is crucial to producing a superior thin film by sputtering processes. Figures 15 through 21 illustrate a heating assembly configuration which accomplishes this goal in sputtering apparatus 10.

Specifically, sputtering apparatus 10 includes a heating assembly whose elements are distributed between dwell heating chamber 14, passby heating chamber 16 and dwell chambers 18 and 22.

As shown in Figures 15 through 17, dwell heating chamber 14 features eight horizontal banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D of tubular quartz radiant heating lamps 1514. Banks 1510A, 1510B, 1620A and 1620B are housed in one shallow gold-plated stainless steel tray 1512 and banks 1510C, 1510D, 1620C and 1620D are housed in a second shallow gold-plated stainless steel tray 1512. Each bank 1510A, 1510B, 1510C, 1510D includes eleven 1.5 kW lamps 1514 connected in parallel, vertically aligned and interdigitated to overlap lamp ends between the banks. Individual lamps are separated horizontally by a distance of 3 inches. Each bank 1620A, 1620B, 1620C and 1620D includes three 1.5 kW lamps 1514 connected in parallel, horizontally aligned and interdigitated to overlap lamp ends within each bank. Tubular quartz radiant heating lamps such as those commercially available from General Electric Corporation Lamp Division of Albany, New York are suitable for this purpose.

Within each tray 1512, banks 1510A, 1510B, 1620A and 1620B, and banks 1510C, 1510D, 1620C and 1620D are arrayed vertically. Trays 1512 measure 37.5 in. long (l) by 2-5/8 in. deep (d) by 32-3/8 in. wide (w), with one tray 1512 mounted on chamber door 114, and the other

mounted on rear chamber wall 99. Each tray 1512 is protected from overheating by a circulating coolant fluid provided through cooling lines 1516.

As shown in Figures 18 through 20, passby heating chamber 16 includes ten horizontal banks 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A, 1920B, 1920C, and 1920D of tubular quartz radiant heating lamps 1514. Each bank 1818A, 1818B, 1818C, 1818D, 1818E, and 1818F features six 1.5 kW lamps 1514 of the same type and mounted in the same fashion as those in dwell heating chamber 14. Individual lamps 1514 are separated by a distance of 2 inches. Each bank 1920A and 1920B features a single horizontally aligned 1.5 kW lamp 1514.

Banks 1818A, 1818B, 1818C, 1920A and 1920B, are arrayed vertically in gold-plated stainless steel tray 1812 and banks 1818D, 1818E, 1818F, 1920C and 1920D are arrayed vertically in a second gold-plated stainless steel tray 1812. With the exception of housing five horizontal banks each, instead of four, trays 1812 are identical in measurement and respective mounting to chamber door 116 and rear chamber wall 100 as trays 1512 in dwell heating chamber 14. Likewise, trays 1812 feature cooling lines 1716 to provide protection from overheating.

The output from banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D, 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A and 1920B, may be set and monitored for individual lamp operating voltages and currents via the electronic controlling system, described fully in Section K, to operate at desired power levels and for desired periods of time. In the present embodiment, heater banks 1510A-1510D, 1620A-1620B, 1818A-1818F, and 1920A-1920D are operated in sets, wherein each set comprises banks 1510A/1510B, 1510C/1510D, 1620A/1620C,

and 1620B/1620D, operated in parallel. Alternatively, bank sets 1620A/1620C, 1620B/1620D, 1510A/1510C, and 1510B/1510D, may be operated in parallel. Similarly, opposing banks 1818A/1818D, 1818B/1818E, 1818C/1818F, and 1920A/1920D are adjustably controlled in parallel. Preferably, independent control of each bank 1510A-1510D, 1620A-1620B, 1818A-1818F, and 1920A-1920B, may be provided by the electronic control system. Such control of banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D, 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A, 1920B, 1920C, and 1920D facilitates adjustment of heating power to meet the preheating requirements of different substrate materials.

As shown in Figure 21, dwell chambers 18 and 22A and 22B each have two gold-plated stainless steel reflecting panels 2120, one each on opposite chamber walls 118, 122A, and 122B and rear chamber walls 101, 102 and 104. Reflecting panels 2120 measure 34-3/8 in. in length by 28 in. in width by 0.09 in. thick.

The heating assembly cooperates with the other elements of sputtering apparatus 10 to contribute to the overall high throughput and high quality sputtered films produced. Specifically, as pallet 800 proceeds through dwell heating chamber 14, banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C and 1620D rapidly commence heating to warm both sides of disk substrates 510 before film deposition. If, for example, the desired substrate temperature is about 200°C, the heating time in dwell heating chamber 14 is approximately 30 seconds. Heating lamp warmup time is negligible since low power (about 143 W) is delivered continuously to the lamps to keep lamp filaments warm.

In the geometrically uniform array of heating lamps created by banks 1510A, 1510B, 1510C and 1510D, more

heat is radiated towards disk substrates 510 carried in the center of pallet 800 as compared to disk substrates 510 carried in rows 810, 820, 870 and 880. In combination with efficient heat reflection from gold-plated stainless steel trays 1512, there is a need to equalize across pallet 800 the amount of heat radiated to individual disk substrates 510. Banks 1620A and 1620B serve as 'trim heaters' to boost the amount of heat radiated to disk substrates 510 carried in rows 810, 820, 870 and 880 of pallet 800. Although such trim heaters are not required, through equalization of heat distribution across pallet 800, trim heaters 1620A and 1620B allow control of coercivity of the deposited film to within about 60 Oe.

To further insure uniform substrate temperature prior to film deposition, a second heating cycle is performed in passby heating chamber 16. Pallet 800 enters passby heating chamber 16 through door D3. The electronic control system enables high power input to banks 1818, 1920, for example, through internal software timers or by reading the output of optical sensor SEN10 (shown generally in Figure 12) capable of detecting pallet motion through the sputtering apparatus 10. As pallet 800 begins to depart passby heating chamber 16, the electronic control system reduces the power of those lamps 1514 positioned at the leading edge of pallet 800 or turns off power to those lamps entirely in response to timing parameters incorporated in the electronic control system software, or sensor SEN13, in order to avoid relative overheating of the trailing edge of the pallet 800.

Banks 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A and 1920B are initiated and will deliver heat for a preset, empirically determined time as monitored by a

software timer in the electronic control system. In addition, a software delay timer is triggered to control the opening of door D3, allowing pallet 800 to proceed into passby heating chamber 16. As a result, when pallet 800 triggers SEN13 in dwell chamber 18, after a certain period, lamps 1514 on the leading edge of pallet 800 are reduced in power or turned off entirely, depending on the transport speed through dwell chamber 18. In addition, a Mikron temperature sensor (not shown) may be positioned at the entrance of passby heating chamber 16, allowing the system operator through the electronic control system to adjust the power output of banks 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A, 1920B, 1920C and 1920D to compensate for thermal variations between disk substrates 510 and across pallet 800. In this manner, a uniform temperature profile is established across the surface of pallet 800 and between individual disk substrates 510, thereby avoiding higher coercivities for those substrates positioned on the trailing edge of pallet 800.

Radiative heat losses from pallets and substrates proceeding through sputtering apparatus 10 are minimized by virtue of gold-plated stainless steel reflective panels 2120.

The cooperation of these elements in the heating assembly contributes to the high throughput of sputtering apparatus 10 by promoting rapid and uniform heating of substrates before film deposition. The heating assembly also efficiently maintains the desired substrate temperature by minimizing radiative heat losses as disk substrates 510 proceed through sputtering apparatus 10. Moreover, integration with the electronic control system introduces added flexibility with respect

to selecting and adjusting dwell times and heating rates as required by different substrates and sputtered films.

I. Sputtering Chambers in General

As shown in Figures 1 and 2, the present invention includes three in-line sputtering chambers 20, 26, and 28 to deposit a multilayer film, including chromium, CoCrTa and carbon thin films, respectively. Those skilled in the art will recognize that the application of the following principles to design a sputtering apparatus with greater or fewer sputtering chambers or with the capability to deposit more or fewer films is within the contemplation of the present invention. Moreover, all of the sputtering chambers within a particular sputtering apparatus need not be devoted to sputtering films. Indeed, any given sputtering chamber may participate in the overall process solely to the extent of serving as a pressurized inert passageway for substrates.

The following description relates to the internal configuration of each sputtering chamber, which is symmetrical about the line of pallet travel through the sputtering apparatus 10. Figures 13, 14 and 23 through 28 illustrate various aspects of the sputtering chambers and will be referred to as necessary.

Referring to Figures 13, 14, 22 and 23, sputtering chamber 20 generally represents the internal configuration of sputtering chambers 20, 26 and 28. By way of explanation, only chromium sputtering chamber 20 will be hereafter described. Only one-half of the chamber is described with the understanding that the description applies to both halves.

Four planar (rectangular) cathodes 2222, 2223, 2224 and 2225 are mounted through insulative layer 121 to

door 120. Door 120 is rotatable about hinge 1326 to allow access to the interior of chromium sputtering chamber 20, for example, for maintenance purposes. Interlocked protective cover 2305 interrupts the power supply to chromium sputtering chamber 20 when door 120 is opened.

Cathodes 2222-2225 may be composed of a material such as copper and measure about 36 inches in length by 5-1/2 inches in width by 1.125 inches thick. Cathodes 2222-2225 are provided with cooling lines 2552 to protect against overheating. Cooling lines 2552 supply a cooling fluid such as water along cooling conduits 2554 in cathode surface 2550.

As illustrated in Figures 14, 22 and 23, targets 2226-2229 are mounted one per cathode 2222-2225, with the target being nearest the line of pallet travel through chromium sputtering chamber 20. Within any given sputtering chamber, the composition of all four targets depends upon the film to be deposited, but may be chromium, a magnetic alloy or carbon. Likewise, the thickness of the targets depends upon the type and the thickness of the film to be deposited. In the case of the chromium and magnetic sputtering chambers 20 and 26, the target-to-substrate distance 'a' is about 2-3/4 inches and the target-to-substrate distance 'a' for carbon targets is 2-11/16 inches because the chromium and magnetic targets are thicker than the carbon target.

Referring now to Figures 21 through 24, shields 2230, 2236, 2238 and 2240 are mounted one per cathode 2222-2225. Shields 2230, 2236, 2238 and 2240 may be composed of a material such as copper and are generally rectangular in shape with peripheral flanges 2232 and 2234. Shield extension 2231 extends from shield 2230 into the chamber interior. Shields 2230, 2236, 2238 and

2240 are cooled by cooling lines 2336. A combined anode and dark space shield 2338 is incorporated into each shield 2230, 2236, 2238 and 2240.

The sputtering process occurs with the targets sputtering in a sideways fashion, depositing the desired film on each side of disk substrates 510 as pallet 800 proceeds through each sputtering chamber. As Figures 27A and 27B show, during sputtering, flux (represented by vectors $\bar{A}$ and $\bar{B}$) leaves the target surface diffusely, depositing on the disk substrates and other surfaces within the sputtering chamber. As discussed previously, in-line sputtering of disk substrates can introduce undesirable magnetic anisotropies into the deposited film. Shields 2230, 2236, 2238 and 2240 intercept the obliquely incident flux (vector $\bar{A}$) from targets 2226-2229 such that only flux substantially normal to the surface of target 2228 (vector $\bar{B}$) is deposited on disk substrates 510. Specifically, peripheral flanges 2232 and 2234, extending the length of each shield, project toward the line of pallet travel through any given sputtering chamber. Shield 2230 also features shield extension 2231 which similarly projects toward the line of pallet travel. Peripheral flanges 2232 and 2234 and shield extension 2231 block deposition from high- and low-angle flux (vector $\bar{A}$) as disk substrates 510 enter and exit each sputtering chamber, while providing an unhindered path for normal flux (vector $\bar{B}$) to the substrates.

Figures 25 and 26 illustrate the configuration of cathode 2222 in more detail. Cooling lines 2552 discharge cooling fluid along surface 2550 in shallow channels 2554 and an O-ring (not shown) disposed in channel 2556 prevents coolant leakage outside of channels 2554. On the reverse side of cathode 2222,

surface 2658 is adapted to receive screws in holes 2660 for mounting cathodes 2222-2225 onto chamber doors 120-1 and 120-2. Surface 2658 is configured to support and receive a magnet and magnetic pole piece assembly to produce the desired magnetic field. The assembly is created in a network of channels in surface 2658 consisting of center channel 2662, intermediate circumferential channel 2664 and outer circumferential channel 2666. Channels 2664 and 2666 are configured as concentric closed loops or ovals surrounding center channel 2662.

Typically, target utilization in sputtering operations are about 15-20% for nonmagnetic materials and about 30-35% for magnetic materials. Considering the high costs associated with the purchase and replacement of target materials, optimal target utilization is another prime concern in sputtering operations. Magnet and magnetic pole piece assemblies used in the present invention substantially improve target utilization, enhancing both production throughputs and cost-effectiveness.

Figures 27A and 27B illustrate in greater detail the magnet and magnetic pole piece assemblies for nonmagnetic (e.g., chromium and carbon) and magnetic (e.g., CoCrTa) targets, respectively. Each magnet 2768 is 1-inch long by 5/16-inch wide by 3/16-inch thick and magnets 2769 are 1-inch-long by 5/16-inch wide by 3/8-inch thick, with north and south pole directions indicated by arrows pointing up and down, respectively. Ferritic magnets of neodymium, iron and boron (NeFeB or "Neo iron") are preferred in the present invention.

Along with magnets 2768 and 2769, magnetic pole pieces 2770 and 2774 are arrayed in channels 2662, 2664 and 2666. Magnetic pole pieces 2770 may be adapted to

receive screws therethrough for securing the magnet and pole piece assembly within the channels as necessary. A nonmagnetic material 2772, such as aluminum in block or continuous form, is positioned so as to fill the channels as necessary and preclude shunting of the magnetic flux between adjacent magnetic pole pieces 2770. Iron plate 2274 serves as a backing plate for the magnetic and pole piece assembly.

For a nonmagnetic target layout, center channel 2662 of each cathode contains about 25 magnets 2769 separated by 1/4-inch spaces and 25-inch pole piece strips 2770 above and below magnets 2768. Intermediate circumferential channel 2662 contains about 35 magnets 2768 separated by 1-inch spaces, two 31-inch pole piece strips 2770, two 31-inch pole piece strips 2774 adjacent to aluminum filler 2772 with additional pole pieces 2770 for fitting the cropped corners of intermediate channel 2664. Outer circumferential 2666 contains about 33 magnets 2769 and two 33-inch pole piece strips 2770 with additional pole pieces 2770 for fitting the cropped corners of outer circumferential channel 2666. The overall effect of the magnet and the pole piece assembly for the nonmagnetic target shown in Figure 27A is to produce a magnetic field strength above the target surface of 400 Gauss at the center of the erosion region.

For a magnetic target layout, center channel 2662 contains about 25 magnets 2769 with one overlying 25-inch pole piece 2770. Intermediate circumferential channel 2664 contains about 35 magnets 2768 overlaid with two 31-inch pole pieces 2770 and additional pole pieces 2770 for fitting the cropped corners of intermediate channel 2664. Aluminum filler material 2772, in block or continuous form, occupies remaining

vacancies in intermediate channel 2664. The overall effect of the magnet and pole piece assembly for a magnetic target shown in Figure 27B is to produce a magnetic field strength of about 400 Gauss at the center of the erosion region.

As noted above, the purpose of the magnetic field is to trap electrons and ionized species in the plasma and enhance the sputtering rate induced by the circulating plasma above the target surface. The magnetic field 2700 generated by the magnet and magnetic pole piece assemblies used in the present invention approximate an ideal magnetic field 2700 where the vertical components of the magnetic fields above the nonmagnetic (Figure 27A) and magnetic (Figure 27B) targets are reduced. As a result, greater target utilization is obtained since the magnetic fields and plasma are focused across a relatively greater portion of the target surface.

Target utilization may be further improved by increasing the magnet loading density within the channel network. For example, by loading intermediate channel 2664 with 24 magnets 2768 separated by 1/2-inch spaces, nonmagnetic target utilization increases to between 50% and 65%. For magnetic targets, an increased utilization of between 35% to 50% may result.

Figure 28 illustrates the film structure which may be produced by the present invention on nickel-phosphorus plated aluminum disk substrate 510. A 800Å to 2000Å (1000Å preferably) chromium underlayer 2800 is deposited first on disk substrate 510. A 500Å to 850Å CoCrTa magnetic layer 2802 may be deposited over the chromium underlayer. As a result of the circumferential texturing of the disk surface as discussed previously in Section C.2, the 'C' axis of the hcp structure of the magnetic cobalt alloy is aligned in the film plane.

Finally, a 350Å carbon overlayer 2804 may be deposited, incorporating some hydrogen, as discussed in Section J.

J. <u>Carbon Sputtering</u>

Sputtering chamber design in sputtering apparatus 10 for carbon films requires additional refinements to optimize wear and corrosion resistance properties. These refinements are discussed herein with reference to Figure 13, as necessary.

Experiments have shown that the incorporation of hydrogen into sputtered carbon films improves wear-resistance properties. In sputtering apparatus 10, hydrogen incorporation is achieved by sputtering in an argon atmosphere containing up to about 15% of a hydrocarbon gas. In particular, carbon films sputtered in the presence of ethylene/argon or acetylene/argon showed a 300% improvement in wear resistance as compared to carbon films sputtered in pure argon atmospheres. Thus, as compared to chromium and magnetic sputtering chambers 20 and 26, carbon sputtering chamber 28 uses a gas line for argon/hydrocarbon gas mixture to supply hydrocarbon gas flow during sputtering.

A second type of chamber refinement in the carbon sputtering chamber relates to the need for substrate bias. As noted above, during sputtering, primary or "fast" electrons dislodge from the target and join the plasma. These fast electrons are constrained to field lines in the plasma where they may ionize argon atoms or may be attracted to positively biased regions within the sputtering chamber. Deposition of dielectric target materials, such as carbon, on surfaces other than the substrate can reduce the electrical conductivity of those surfaces and inhibit the electron grounding thereon. As a result of the reduced electrical

conductivity, fast electrons either scatter and ionize argon, or are therefor available to impinge on the substrate, whether positively biased or grounded. In the event of the latter, the substrate may be heated sufficiently by electron bombardment to cause graphitization of the growing carbon film.

One means of avoiding graphitization resulting from electron bombardment of the substrate is to apply a negative bias to the substrate to repel any stray electrons. As shown in Figure 13, arcuate phosphorus-bronze fingers 1302 depending from insulating block 1304 and connected to an external voltage source (not shown) provide an electrical contact to pallet 800 by which a negative bias may be applied. More specifically, as pallet 800 proceeds through carbon sputtering chamber 28, phosphorus-bronze fingers 1302 brush against the bottom edge of pallet 800 and establish the desired negative bias. At least one phosphorus-bronze finger 1302 maintains contact with the moving pallet while pallet 800 is in carbon sputtering chamber 28.

A third refinement relates to a reduction of pallet transport speed through carbon sputtering chamber 28. As a target surface is increasingly eroded during sputtering, the once-flat surface eventually develops a depression which mirrors the magnetic field lines. As a result, the magnetic field lines emerging from the target are no longer perpendicular to the electric field lines at the target surface. The significance of the growing erosion region is that during sputtering, target species continue to leave the erosion region in a path perpendicular to the surface, i.e., according to a cosine distribution, even where the eroded target surface is no longer uniformly flat. Therefore, an increasing portion of the flux leaving the target

surface is intercepted by shields 2230 as otherwise obliquely incident flux. In other words, a correspondingly decreasing portion of the flux is deposited on disk substrates 510 (and pallet 800) as the desired normally incident flux, thereby decreasing the overall film deposition rate. In general, such a decrease in deposition rate may be compensated for directly by increasing the power supplied to the cathodes. For carbon targets, it has been discovered that this method of compensation is impracticable because increased power input to and resultant heat from the cathodes would induce undesirable graphitization.

The carbon target is also altered by redeposition of carbon from the flux into the erosion region. Specifically, since carbon is a dielectric material, such redeposition reduces the electrical conductivity of the target, further decreasing the carbon sputtering rate and may cause arcing. For conductive target materials like metals, redeposition is not similarly problematic.

Accumulations of the redeposited carbon, which appear as large blemishes or warts, may be removed by grinding the carbon surface. However, such a solution to the redeposited carbon problem is time- and labor-intensive, and consequently is not preferred because it detracts from the high throughput capability of the sputtering operation of the present invention. A much more manageable and attractive solution directly minimizes graphitization by holding deposition power to the cathodes constant and reducing the pallet transport speed from the typical rate of 3 feet/minute, via the electronic control system to, for instance, about 2.8 ft/min, to compensate for the lower deposition rate.

K. Electronic Control System

The electronic control system for sputtering apparatus 10 and the process of the present invention provides one or more system operators with the means to comprehensively and efficiently control production throughput, applied sputtering power, and other sputtering apparatus parameters. The electronic control system is preferably programmable to allow a plurality of different operating parameter settings to be stored for each of the adjustably controlled elements of the sputtering process. Thus, the electronic control system generally performs two major functions: (1) monitoring sputtering apparatus 10 by reading data input from every aspect of sputtering apparatus 10, and providing status data to the system operator(s); and (2) controlling the sputtering process by providing user-controlled and automatically generated control signals to the functional elements of sputtering apparatus 10.

The electronic control system of the present invention will be described with regard to Figs. 12, 29 and 30. Figure 12 is a diagram of the vacuum and chamber pumping system of the present invention, including general representations of the location of the various signals and components controlled, or read by, the digital input/output of programmable logic controller 2902. Figures 32A-B represent a logical flow diagram of the programmable logic software controlling the motor assemblies powering transport platform arranged in chambers 12-30 in apparatus 10 of the present invention.

Referring to Figure 29, the major functional elements of the control system of the present invention are shown. Since both digital and analog input/output must be provided for in one embodiment, two main process

controllers are used: a programmable process logic controller 2902, preferably an Allen Bradley PLC-5 programmable process logic controller, and an IBM-compatible, Intel-type 80386 or 80486 microprocessor based, computer 2901. It should be understood by those skilled in the art after review of the specification that the particular choice of process controllers is not crucial to the invention, as long as the process controller(s) can sufficiently handle input/output (I/O) in both analog and digital form to meet the comprehensive requirements of the control system described herein.

The Allen Bradley PLC-5 is manufactured by Allen Bradley Company, Milwaukee, Wisconsin, and includes at least one PLC-5 processor module and a number of input/output modules attached thereto. The input/output modules provide an expandable number of inputs and outputs to handle any number of digital I/O signals.

Programmable logic controller 2902 monitors digital input and provides digital output to those elements of the sputtering apparatus which require two-state control signals. These elements are described in detail below. Allen Bradley PLC-5 uses logic control software configured as "ladder" logic table diagram, a copy of which is included in Section M, to control input and output. In general, this software allows programming of the sensory input and output in a Boolean-type fashion along a series of horizontal timing "rungs". The entire "ladder" is scanned, top to bottom, every .030-.040 second, and each addressed element of I/O is examined by the processor. Each rung is programmed with both internal and external I/O, and generates an output command -- either internal or external -- if each element in the horizontal rung is "true". In this

manner, it will be recognized that horizontally linked elements are ANDed together, while vertically linked elements are ORed. Each rung may be cross-referenced and nested to other individual rungs to achieve the desired logical output. The output of each rung may comprise an "enable," "latch" or "unlatch" signal, depending on the nature of the timing utilized in the particular program.

Computer 2901 primarily controls analog input/output to the various elements of sputtering apparatus 10 via a SIXNET network interface 2903, such as that manufactured by Digitronix SIXNET, Inc., Clifton Park, New York, although some digital input/output functions are handled by the computer 2901. The SIXNET network interface 2403 is coupled to computer 2902 via 307,200 baud SIXNET Model 60-232/N-DL network modem (not shown) coupled to a RS-232 serial port on, for example, a peripheral extension card provided in an expansion slot of computer 2901. Such an extension card may comprise, for example, an IBM Real Time Interface Co-Processor (ARTIC) card manufactured by International Business Machines, Boca Raton, Florida.

In order to handle a sufficient quantity of digital and analog I/O, the network interface 2903 comprising a SIXNET I/O network may include eight SIXNET 60 I/O MUX-FEB multiplex stations, each of which may include two RS-232 serial ports or alternative expansion capability, and sixteen dedicated I/O terminals. The multiplex stations are interlinked by the 307K baud SIXNET network interface. Data I/O of each such station may be configured as the constraints of the physical facility and sputtering apparatus 10 require to couple the necessary I/O signals to the network interface 2903. Network interface 2903 may include SIXNET 60-A/D 16-32

analog-to-digital converters, 6-D/A 12B-8 digital-to-analog converters, and 6-I032 FET digital/analog input/output modules to handle additional digital and analog I/O as required.

Programmable logic controller 2902 and computer 2901 may communicate via a data highway 2911, utilizing an RS-232 serial bus coupled between one RS-232 serial port of the ARTIC peripheral card (discussed above) located in computer 2901, and an Allen Bradley 1171-KF2-B communications interface 2911. Interface 2911 is coupled to programmable logic controller 2902 via serial data highway 2912.

Computer 2901 utilizes a user interface and system control software to monitor, control, generate alarms and store data for apparatus 10. One such software suitable for this purpose is "The Fix", produced by Intellution Corporation, Norwood, Massachusetts. The software allows development of a graphic interface environment for data input/output by creating signal control databases linking the particular interface environment to specific control signals output from, and data sensing signals input to, computer 2901. Thus, input data is transmitted via network interface 2903 from the various components of apparatus 10 to computer 2901 to be provided as direct readout to the user I/O environment created using the interface and control software to provide easily readable data to the system operator and/or to create output flags to programmable logic controller 2902.

A limited number of output signals are provided by The Fix software to programmable logic controller 2902. These signals comprise combinational results of specific input signals and act as triggers for programmable logic controller 2902. This specific programming code utilized

in "The Fix" software to generate these signals is included as Section N.

As with the particular process controllers utilized in the present invention, it will be noted by those skilled in the art that the particular software utilized in the process controllers to provide data input/output is not crucial to the substance of the invention; any suitable process control software may be utilized within the scope of the invention to generate any number of suitable user interfaces.

A second, IBM compatible computer 2907 is coupled to programmable logic controller 2902. Computer 2907 may be utilized as a separate programming computer allowing on-line monitoring, debugging, and programming of the ladder logic software in programmable logic controller 2902 utilizing a debugging software, such as that manufactured by ICOM Incorporated, Milwaukee, Wisconsin.

User interfaces are provided for both programmable logic controller 2902 and computer 2901. User interface 2905 coupled to programmable logic controller 2902 may comprise a NEMATRON touch screen, manufactured by NEMATRON, Inc., Ann Arbor, Michigan, which allows data input/output through a series of custom designed, touch sensing, display screens. When utilizing the NEMATRON touch-screen with the Allen Bradley PLC-5, a BASIC module 2906 is provided in the Allen Bradley and coupled to the NEMATRON. The BASIC module is utilized for selecting the display screens on the NEMATRON and for linking particular screen input/output to the data input/output of the Allen-Bradley PLC-5.

Computer 2901 is coupled to user interface 2904, which preferably comprises a standard high resolution graphics display monitor and keyboard. An EGA or VGA

type high-resolution graphics display, such as the NEC Multisync II, manufactured by NEC Information Systems, Inc., Boxborough, Massachusetts is suitable for use as user interface 2904. Again, it should be understood that any conventional input/output interface may be utilized with the process controllers of the electronic control system while remaining within the scope of the invention.

The electronic control system of the present invention governs three major functions: movement of the substrate through apparatus 10; sputtering process control within apparatus 10; and status indication for apparatus 10. Referring to Figure 29, movement of the pallet 800 and disk substrate 510 through the process is governed by the electronic control system through motor control system 2910, position sensing system 2915, and door control system 2920. Process control and status indication are governed by mechanical pump control system 2925, pump valve and vent control system 2930, cryogenic pump and compressor control system 2935, vacuum valve control system 2940, gas flow control system 2945, gas pressure control system 2950, heater control system 2955, substrate temperature sensing system 2960 sputtering power supply control system 2965, coolant control system 2970, gauge control system 2975 and residual gas analyzers 2980.

With reference to Figure 29, the elements of the electronic control system, and their relationship to programmable logic controller 2902, computer 2901, and network interface 2903 are hereinafter described. It should be understood by those skilled in the art that the elements defined in Figure 29 are arranged in the manner shown for explanation purposes only; various

modifications of the system are contemplated as being within the scope of the invention.

1. Motor Control System 2910

Movement of the substrate through in-line sputtering apparatus 10 is controlled by the substrate transport system, discussed with the reference to Figs. 8-11. As noted therein, each separate transport platform 2400 has a variable speed motor assembly associated therewith and coupled thereto controlling the velocity of the substrate movement at that specific platform in the transport system loop.

With respect to apparatus 10, nineteen (19) individual transport platforms are provided to carry the substrate through the seventeen (17) chambers of sputtering apparatus 10, and load and unload ramps, 210, 212, respectively. Nineteen motors M3-M21 are controlled by three BAM-8 Berkeley Axis Machine (BAM) multi-access servo controllers (not shown). Each BAM-8 can simultaneously control up to eight axis of high performance servo motors, and provide multiple, preset, user-defined motor speeds for each axis, allowing digital input signals to activate preprogrammed control sequences for each axis controlled by each particular BAM-8. Each BAM-8 provides eight separate variable voltage output signals, one per axis, to the motor assemblies to control motor speed and, consequently, the velocity of the target substrate at each particular platform in the transport system. Each BAM-8 is preferably coupled by one RS-232 port from one of the eight SIXNET multiplex stations to each BAM-8.

Two sets of nineteen digital outputs from programmable logic controller 2902 provide motor velocity control signals M3F-M21F, M3S-M21S to the BAM-

8 motor controllers. The two-bit control signal provided by signals M3F-M21F, M3S-M21S allows two individual forward speed settings, start/stop, and, forward/reverse direction to be controlled by programmable logic controller 2902. Nineteen additional digital outputs from programmable logic controller 2902 provide motor interrupt signals M3I-M21I to the BAM motor controllers.

Thirty-eight (38) analog output signals DMOTLO1-DMOTLO21, DMOTHI1-DMOTHI21 are provided for selection of individual motor speed set points of motors M3-M21. The high and low speed setpoints defined by DMOTLO1-DMOTLO21, DMOTHI1-DMOTHI21 define the motor speeds controlled by signals M3F-M21F, M3S-M21S from programmable logic controller 2902; once set, the BAM-8 automatically controls each motor to meet the desired setpoint state. Optimal motor setpoints are listed in Table 1:

TABLE 1

Motor #	Setpoints (ft./minute) Fast	Slow
M3	12.0	7.5
M4	12.0	7.5
M5	12.0	6.0
M6	6.0	6.0
M7	6.0	6.0
M8	6.0	6.0
M9	12.0	6.0
M10	12.0	6.0
M11	12.0	6.2
M12	12.0	6.2
M13	6.0	6.2
M14	6.0	6.0
M15	6.0	2.7
M16	6.0	2.7
M17	12.0	2.7
M18	12.0	6.0
M19	12.0	6.0
M20	12.0	6.0
M21	12.0	6.0

Hence, motor control system 2910 provides multiple velocity movement of a substrate through the sputtering apparatus which is useful for controlling a plurality of substrates moving through the sputtering system simultaneously.

2. Substrate Position Detection System 2915

Substrate position detection system 2915 represents the capability of electronic control system to detect and monitor movement of all substrates entering, exiting, or passing through apparatus 10. Fifty-seven pallet position sensors SEN1-SEN57 may be provided in chamber modules 12-30, and entrance and exit platforms 210, 220 to inform programmable logic controller 2902, (and the system operator) of the exact position of each substrate in apparatus 10. Generally, three sensors per pallet platform are provided. Preferably, optical

position sensors are utilized in chambers 14 and 16 due to their ability to withstand the high temperatures present in those chambers. It should be recognized that it is preferable to provide three sensors per platform for greater accuracy in determining substrate position; in the present embodiment, to improve durability, only two position sensors are utilized in chambers 14 and 16 to reduce sensor failure rates. Each sensor SEN1 - SEN57 provides a digital output signal to programmable logic controller 2902 indicating the presence or absence of a substrate at the sensor's position. Such a comprehensive position detection system provides fault detection in the event a substrate becomes jammed at any point in the sputtering process, permitting the user to compensate for such problems and forestall problems on subsequent substrates in apparatus 10.

Twenty-one additional pallet position sensors (not shown) are provided on the twenty transport platforms utilized in return path 50 (two on the last platform before load station 40). Each such sensor output signal may be provided to programmable logic controller 2902, as shown in Figure 12; alternatively, return path sensor signals may be provided to a separate programmable logic controller.

3. <u>Door Control System 2920</u>

Twelve chamber isolation doors D1-D12 are provided to separate certain individual ones of compartment chamber modules 12-30. Each door D1-D12 is operated by a pair of pneumatic cylinders (not shown), each cylinder having a pair of solenoid triggers responsive to DROP and DRCL signals to each cylinder in a direction to open or close the door, respectively. Movement of each of doors D1-D12 is governed and detected by door control

system 2920. Twenty-four (24) dedicated digital outputs from programmable logic controller 2902 provide pulsed control signals to door open solenoids DROP1-DROP12, and door close solenoids DRCL1-DRCL12.

Additionally, door position sensors are provided to detect each door's opened or closed state for the control system software. Door open sensors DROP1S-DROP12S and door closed sensors DRCL1S-DRCL12S provide direct digital output signals to twenty-four (24) digital inputs of programmable logic controller 2902.

A high pressure air supply (not shown) is used in the sputtering apparatus to provide the requisite air pressure for the pneumatic valves, including door cylinders, high vacuum valves, and other such system components. Primary air sensor APS detects the existence of the high pressure air supply and the absence of a ABS detection signal input to one input of programmable logic controller 2902 initiates a system shutdown override. In addition, eight pressure switches PS1-PS8 are provided to check for the existence of discrete pressure states at various points in the pumping system and apparatus 10. Switches PS1-PS8 redundantly check for a lack of evacuation pressure in pumping conduits in apparatus 10 in the position as shown. Eight digital output signals indicating the detection, or lack thereof, each discrete pressure state are input to programmable logic controller 2902.

4. Mechanical Pump Control System 2925

Three mechanical roughing pumps MP1-MP3 and blowers BL1-BL3 provide initial vacuum pumpdown of sputtering apparatus 10, and explosive pumpdown in load lock 12 and exit lock 30 in accordance with the description of the pumping system discussed in section F of this

specification. Mechanical pumps MP1-MP3 provides high speed pumping up to approximately 20-50 mTorr, while blowers BL1-BL3 provide pumping down to about 1 mTorr before the cryo pumps engage. Mechanical pumps MP1-MP3 and blowers BL1-BL3 thus act in concert to provide rapid pumping of apparatus 10.

On/off controls for mechanical pumps MP1, MP2, and MP3, and blowers BL1, BL2, and BL3, are provided by six digital output signals from programmable logic controller 2902.

5. <u>Mechanical Pump Valve and Vent Control System 2930</u>

Five roughing valves RV1-RV5 isolate mechanical roughing pumps MP1-MP3 and blowers BL1 - BL3 from chambers 12-30 of sputtering apparatus 10. In addition, five chamber vent valves CV1-CV5 allow for venting chambers 12, 18, 22B, 22D, and 30 between the evacuated, sputtering atmosphere and the ambient environment outside apparatus 10.

Mechanical pump valve and vent control 2930 controls roughing valves RV1-RV5, monitored by roughing valve sensors RVS1-RVS10, and chamber vent valves CV1-CV5, monitored by chamber vent sensors CVS3-8. In the absence of sensors associated with any valves, the on/off condition of any valve can be determined by referencing the software output commands (for example, for valves CV1 and CV5).

Thirteen outputs of programmable logic controller 2902 are provided to mechanical pump valve and vent control 2930. A first set of five outputs controls the open/close state of roughing valves RV1-RV5, a second set of five outputs controls the open/close state of chamber vent valves CV1-CV5, and a third set of three

outputs controls the open/close state of pump vent valves PV1-PV3. In addition, twenty dedicated digital inputs of programmable logic controller 2902 are provided for signals received from roughing valve sensors RVS1-RVS10 and chamber vent valves sensors CVS3-CVS8. Roughing valve sensors RVS1-RVS10 and chamber vent valve sensors CVS3-CVS8 provide state signals to programmable logic controller 2902 to indicate the state of each respective valve CV2-CV4 monitored, thereby allowing the user and the system to more accurately monitor pumpdown and venting of the system. Additional chamber vent valve sensors may be provided on chamber vent valves CV1 and CV5, however because of the high usage of these values, sensor failure occurs rapidly.

6. Compressor and Cryogenic Pump Regeneration Control System 2935

The electronic control system includes a cryogenic pump regeneration and compressor control 2935 which controls the start/stop function of compressors CY1-CY12, nitrogen supply N2, and nitrogen heaters NIH1-NIH12. In addition, cryogenic pump and compressor control 2935 provides on/off control to sieve heaters SVHTR1-SVHTR12 and sieve valves SVIV1-SVIV12, used in flushing contaminants from cryogenic pumps C1-C12 during the cryogenic pump regeneration process discussed above. Nitrogen supply N2 and heaters NIH1 - NIH12 are also used to flush and clean cryogenic pumps C1-C12.

As discussed above in section F of this specification, cryogenic pumps C1 - C12 are provided to create an evacuated environment in chambers 12-30 in accordance with the sputtering process of the present invention. Compressors CY1-CY8 (Figs. 3 and 12) provide helium gas to cryogenic pumps C1 - C12 to enable

cryogenic pumps C1 - C12 to create the necessary vacuum in sputtering apparatus.

Eight outputs of programmable logic controller 2902 control the start/stop state of compressors CY1-CY8.

Eight nitrogen flow sensors NIFS1-NIFS8 detect and insure the presence of nitrogen to nitrogen flow heaters NIH1 - NIH12. Eight programmable logic controller 2902 digital inputs receive flow detection signals from sensors NIFS1-NIFS8. Twelve digital outputs of programmable logic controller 2902 control the start/stop functions for nitrogen heaters NIH1-NIH12. An additional twelve digital outputs of programmable logic controller 2902 provide open/close state control over nitrogen flow valves NIF1-NIF12.

Also included in cryo regeneration and compressor control 2935 are sensors, not shown, coupled with cryo pumps C1 - C12 to monitor the temperature of cryo pumps C1 - C12 during the cryo regeneration process and during the sputtering process. Twelve analog network interface 2403 inputs receive the analog temperature signals TD1-TD12, over a range of 3°K - 350°K.

Cryo roughing valves CR1-CR12 are provided to control outgassing of cryogenic pumps C1-C12 through sieve heaters SVHTR1-SVHTR12. As noted above, cryo roughing valves CR1-CR12 function in concert with sieve heaters SVHTR1-SVHTR12 in removing contaminants from cryo pumps C1-C12 during the cryo regeneration process. The open/close states of cryo roughing valves CR1-CR12 are controlled by twelve digital outputs of programmable logic controller 2902.

Control of sieve heaters SVHTR1-SVHTR12 and sieve valves SVIV1-SVIV12 is provided by 24 digital outputs of programmable logic controller 2902: twelve (12) digital outputs of programmable logic controller 2902 control

the start/stop functions of sieve-heaters SVHTR1-SVHTR12; twelve outputs of programmable logic controller 2902 control sieve-isolation valves SVIV1-SVIV12.

7. <u>Vacuum Valve Control 2940</u>

Vacuum valve control 2940 provides on/off switching control for, and receives feedback from, high vacuum valves HV1-HV12 coupled between cryogenic pumps C1 - C12, and sputtering apparatus 10. Feedback for high vacuum valves HV1-HV12 is provided by 32 high vacuum sensors HV1S1, HV1S3, HV2S1, HV2S2, HV2S3, ... HV12S1, HV12S2, HV12S3.

High vacuum valves HV2-HV11 are three state (OPEN, CLOSED, and THROTTLE) operation valves. The THROTTLE state is used during operation of the sputtering system to maintain the vacuum level sputtering apparatus, subsequent to initial pumpdown, as the needs of each particular chamber require. High vacuum valve HV1 operates as a two-state (open/closed) valve, and is utilized with baffle 1210. Twenty-four (24) digital outputs (HV1_1, HV1_2, HV2_1, HV2_2, ... , HV12_2) are dedicated by programmable logic controller 2902 to provide twelve, two-bit control signals for high vacuum valves HV1-HV12 and baffles 1210, 1214, to select one of the three states of valve operation discussed above for valves HV2-HV12, or two states for valve HV1, and enable/disable baffles 1210, 1214. Thirty-five (35) digital inputs of programmable logic controller 2902 monitor high vacuum sensors HV1S1 -HV12S3 for respective valves HV1-HV12. One sensor is provided for each operational state of each high vacuum value as applicable.

8. <u>Gas Flow Control 2945</u>

Gas flow control system 2945 controls the sputtering gas supply for apparatus 10.

Flow control for the primary and secondary gasses, discussed above, may be accomplished through use of eight MKS Instruments, Inc., (Andover, Massachusetts) model 2259B mass flow meters and flow controllers, including MKS model 246 readout displays. Eight isolation valves GF1-GF8 are located between each 2259B mass flow meter and its associated model 246 display. Eight flow control valves FLO1-FLO8 control the flow rate of the primary and secondary gases.

Eight digital outputs of programmable logic controller 2902 are dedicated to control the open/close state of isolation valves GF1-GF8. Computer 2901 receives eight analog input (0-5 volt) flow measurement signals (designated FLO1-FLO8 by "THE FIX") to monitor gas flow via the model 2259B mass flow meters. Flow setpoints of flow controller valves FLO1-FLO8 of the model 2259B mass flow meters are controlled by eight 0-5 volt output signals FLOST1-FLOST8 through network interface 2903 under the control of computer 2901.

9. Gas Pressure Control System 2950

In conjunction with gas flow control system 2945, discussed above, gas pressure control system 2950 monitors and controls pressure in apparatus 10 through a series of four capacitance manometers CM1-CM4, each capacitance manometer CM1-CM4 being separated from apparatus 10 by an associated isolation valve CHV1-CHV4. Each capacitance manometer CM1-CM4 and isolation valve CHV1-CHV4 may comprise, for example, MKS model 390H and 270B capacitance manometers manufactured by MKS Instruments, Inc., supra. MKS model 390H and 270B capacitance manometers include outputs providing analog

output signals to computer 2901 for monitoring the gas pressure measured thereby, and digital signal inputs to allow for variable control of the metering range of each capacitance manometer or CM1-CM4. Generally, capacitance manometers CM1-CM4 monitor pressure in apparatus 10 subsequent to evacuation of chambers 14-29 by mechanical pumps MP1-MP3. Specifically, gas pressure monitoring during pump-down of apparatus 10 is provided by twenty pirani gauges PIR1 - PIR20; at crossover, the point at which evacuation by mechanical pumps MP1-MP3 blower BL1-BL3 ceases and pumping by cryogenic pumps C1-C12 begins, capacitance manometers CM1-CM4 are used.

Four outputs of programmable logic controller 2902 are dedicated to control open/close states of isolation valves CMV1-CMV4. Four inputs of network interface 2903 receive analog pressure readouts (designated CM1-CM4 by "THE FIX") of capacitance manometers CM1-CM4. Eight discrete outputs of network interface 2903 are dedicated to provide 2-bit digital signals CMR1.1, CMR2.1, CMR1.2, CMR2.2, CMR1.3, CMR2.3, CMR1.4, CMR2.4 to control the pressure metering range of capacitance manometers CM1-CM4.

10. Heater Control System 2955

Substrate heating, including dwell heating in chamber 14 and passby heating in chamber 16, to maintain a uniform temperature gradient over the substrate surface is governed by heater control system 2955. Control of both the "dwell" and "passby" heater banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D, 1818A, 1818B, 1818C, 1920A, 1920B, 1920C, 1920D, discussed in Section H of this specification, may be provided by eight Emerson Spectrum III Heater

Controllers, manufactured by Emerson Industrial Controls, Grand Island, New York. The Emerson Spectrum III controllers allow digital heater temperature setpoint control of the quartz lamp heating elements discussed in section H. Thus, heater setpoints once set will be maintained by each Spectrum III.

In the present embodiment, heater control system 2955 thus utilizes: eight digital outputs of programmable logic controller 2902 providing on/off control signals RH1A-RH3C to the Emerson Spectrum III controllers; eight digital outputs of programmable logic controller 2902 controlling high/low output enable RH1A-RH3C for the Emerson Spectrum III controllers; eight inputs of programmable logic controller 2902 receiving heater fault signals H1A0FLT-H3C0FLT; eight analog outputs from network interface 2903 controlling the voltage setpoints of heater bank sets 1510A/1510B, 1510C/1510D, 1620A/1620B, 1620C/1620D, 1818A/1818D, 1818B/1818E, 1818C/1818F, 1920A/1920B, and 1920C/1920D, and eight analog inputs to network interface 2903 monitoring each heater bank set's current setpoint output HSP1-HSP8.

A preferable embodiment of heater control system 2955 would provide individual control of each of heater banks 1510A-1510D, 1620A-1620B, 1818A-1818D, and 1920A-1920D. Such an embodiment would include additional hardware lines to control each of the heater banks coupled to the electronic control system. In an embodiment using Emerson Spectrum 3 controllers, sixteen such controllers would be utilized and sixteen digital outputs of programmable logic controller 2902 would be needed to provide on/off control signals, sixteen digital outputs of programmable logic controller 2902 would be required to provide high/low output enable

signals, sixteen additional outputs of programmable logic controller 2902 would be utilized for heater FALSE signals, sixteen analog outputs from network interface 2903 would be needed to control voltage setpoints of the heater banks, and eight analog input signals to network interface 2903 would be utilized to monitor each heater banks current setpoint output.

11. Substrate Temperature Sensoring System 2960

Six Mikron temperature sensors (not shown) may be provided at various locations throughout the sputtering apparatus in a movable configuration to measure the temperature gradient over the surface of the substrate as it proceeds through various sections of the sputtering apparatus. The Mikron sensors provide 0-5 volt analog output signals TEMP1-TEMP6 through network interface 2903 for output to user interface 2904, thereby allowing the system operator to monitor at every cycle and react each heater bank 1818A-1818C output to maintain a uniform temperature gradient across the surface of the substrate as it proceeds through the apparatus. In general, sensors may be provided in chamber 16 or 18.

12. Power Supply Control System 2965

Power supply control system 2965 controls twenty-four (24) designated forty-eight (48) actual, in master-slave configuration), power supplies PS1A, PS1B, ... PS12A, PS12B which provide high power output to the sputtering magnetrons utilized in Chambers 20, 26 and 28 of sputtering apparatus 10. Power supplies PS1A-PS12B may be Model MDX-20X 20KW DC Plasma Power Supplies, Manufactured by Advanced Energy Industries Corporation,

Fort Collins, Colorado, capable of providing constant current, power, or voltage, and remote control thereof.

Control signals for power supply control 2965 are entirely controlled by computer 2901 through network interface 2903. One hundred sixty-eight inputs of network interface 2903 are utilized as follows:

# of INPUTS	Signal Designation	Function
24	PSLS1A-PSLS12A PSLS1B-PSLS12B	read power supply set point level
24	PSVO1A-PSVO12A PSVO1B-PSVO12B	read power supply voltage output
24	PSCO1A-12A PSC01B-12B	read power supply current output
24	PSO1A-12A PSO1B-12B	read power supply power output
24	PSTL1A-12A PSTL1B-12B	read sputtering target life calculation in power supply
24	PSARC1A-12A PSARC1B-12B	read power supply arc detect sense from power supply
24	PSSR1A-PSSR12A PSSR1B-PSSR12B	read power supply set point signal reached

One hundred six analog and digital outputs of network interface 2903 are provided to the power supplies as follows:

# of INPUTS	Signal Designation	Function
24	PSSP1A-12A PSSP1B-12B	(analog) power supply level set signals
24	PSM1.1-1.12 PSM2.1-2.12	(digital) mode control signals (12 x 2)
24	PSON1A-12A PSON1B-12B	(digital) on/off signals (12 x 2)
3	PSIV1-3	(digital) indicating vacuum chamber interlocks intact
3	PSIW1-3	(digital) indicating water interlocks intact
3	PSIX1-3	(digital) indicating heater cover interlocks intact
1	PSRES	(digital) emergency stop restore

The aforesaid input signals to network interface 2903, including level set point signals, voltage output signals, current output signals, power output signals, target life signals, arc out signals, and set point reached signals, yield precise data feedback for provision to both the user and the control system

software to monitor power supply performance. Interlock control signals PSTV1-PSTV3, PSTW1-PSTW3, PSTX1-PSTX3 are coupled to sensors (not shown) on interlock protective covers 2305 of sputtering apparatus 10 to cut out power supply output if the signals are tripped by an open interlock protective cover 2305 thereby preventing operator injury.

13. Coolant Control 2970

Circulating coolant fluid, such as water, is provided to various components of the sputtering apparatus to maintain temperatures within acceptable operating levels during production thereby forestalling rapid depletion of these system components. Specifically, coolant is provided to heaters 1512, shields 2230, compressors CY1-CY8, and sputtering cathodes 2222.

Coolant control system 2970 monitors the temperature level of the circulating coolant flow in the coolant system and controls the open/close states of coolant flow control valves. While the particular layout of the coolant flow system is not shown, it will be understood by those skilled in the art that any suitable number of coolant control schemes may be utilized within the scope of the present invention. The location of coolant flow sensors CHR1A/CHR1B - CHR4A/CHR4B; MAG5A/MAG5B - MAG8A/MAG8B; CAR9A/CAR9B - CAR12A/CAR12B, is shown in general form in Fig. 12.

Coolant flow control 2970 includes 24 magnetron cathode coolant flow sensors CHR1A/CHR1B - CHR4A/CHR4B; MAG5A/MAG5B - MAG8A/MAG8B; CAR9A/CAR9B -CAR12A/CAR12B, six sputtering shield coolant flow sensors CHRS1-CHRS2; MAG1-MAG2, and CARS1-CARS2, and six heat shield coolant flow sensors HSFS1-HSFS6. Each of these sensors

provides a digital output signal to one input of programmable logic controller 2902. Six water supply flow control valves CHSUV1-CHSUV2, MAGSUV5-MAGSUV6, and CARSUV9-CARSUV10, two supply valves per sputtering chamber, and six water return path valves CHRTV3 CHRTV4, MGRTV7-MGRTV8, CARTV11-CARTV12, two return path valves per sputtering chamber, are provided. Twelve outputs from programmable logic controller 2902 control the open/close states of the water supply valves and the water return path valves.

In addition, two main coolant on valves HH201 and HH202 are controlled by programmable logic controller 2902.

14. Pirani and Ion Gauge Control 2975

Gauge control 2975 also monitors the outputs of each pirani gauges PIR1-PIR20 and ion gauges monitoring residual ion contaminants in sputtering apparatus.

Vacuum pressure during the pumpdown process prior to crossover between mechanical pumps MP1-MP3, blowers BL1-BL3 and cryogenic pumps C1-C12, is monitored by twenty (20) pirani gauges PIR1 - PIR20 provided in the pumping conduits linking cryo pumps C1 - C12 with sieve valves SVIV1 - SVIV12, in chambers 12, 14, 20, 26, 28, 29 and 30 of sputtering apparatus 10, and in the conduit linking pump MP2 and blower BL2 with apparatus 10. Twelve pirani gauges PIR3-5, PIR7-9, PIR12-14 and PIR18-20 monitor pressure during outgassing in the region between cryo pumps C1-C12 to cryogenic roughing valves CR1-CR12. Seven pirani gauges PIR1, PIR2, PIR6, PIR11, PIR16, PIR15, and PIR17 to pressure monitor of chambers 12, 14, 20, 26, 28, 29 and 30.

Analog signals in the range of 0-10 volts are output from gauges PIR1-PIR20 to indicate the measured pressure

reading of each gauge and are provided to the network interface 2903. Twenty digital signals (designated PIR1 - PIR20) provided to programmable logic controller 2902 inputs to indicate the crossover point set for switchover between mechanical pumps MP1-MP3, blowers BL1-BL3, and cryogenic pumps C1-C12.

Four ion gauges IG1-IG4 (not shown) measure the level of background gas (i.e., water contamination) in chambers 14, 20, 26 and 28 of sputtering apparatus 10. Analog output signals ION1-ION4 are provided by gauge control 2975 network interface 2903 for output to user interface 2904 to provide the system operator with data for controlling the pump-down process.

In the preferred embodiment of the present invention, the pirani gauges and ion gauges are coupled through INFICON gauge monitor subsystems, manufactured by Leybold-Heraeus, Hanau, Germany, which provide an independent power source and hardware for use with the pirani gas and ion gauges discussed above.

15. <u>Residual Gas Analyzers 2980</u>

Residual gas analyzers RGA1 - RGA4 are utilized with sputtering apparatus 10 to monitor system status. Isolation of the residual gas analyzers RGA1 - RGA4 is controlled by the electronic control system by means of four isolation valves RGAV1 - RGAV4. Four dedicated outputs of programmable logic controller 2902 are provided to residual gas analyzers RGA1-RGA4 to open and close analyzer isolation valves RGAV1-RGAV4.

Sensors RGAS1-RGAS4 are provided to four inputs programmable logic controller 2902 to provide a status indication of residual gas analyzer valves RGAV1-RGAV4 indicating valve's opened or closed state.

System Control Software

Figure 30 is an overview flow-chart diagram of the system control software of the present invention. It should be noted that the following description is intended to be a general discussion of the capabilities and functions of the system software. Specific software functions and capabilities will be understood by one skilled in the art after a review of the source code in Sections M and N. It should be further noted that the following discussion does not differentiate between those functions controlled by programmable logic controller 2902 and computer 2901. As will be recognized by those skilled in the art, any of the functions described with respect to Figures 30-32 may be performed by a single process controller or multiple process controllers. The preferred embodiment for performing each of the functions outlined in Figure 30 is shown in Figure 29 and detailed in the source code sections.

As shown in Figure 30, the software architecture is designed to allow both manual and automatic control of select system functions. Certain processes are automated while others depend on comprehensive feedback provided to the user (system operator) allowing the system operator monitor and react to such feedback to make adjustments in particular operating parameters (such as heater power level, and sputtering power supply output levels, etc.) to obtain optimal sputtering characteristics.

In the embodiment of the control software shown in Figure 30, the user or system operator manually controls: gas flow valves GF1-GF8, residual gas analyzer isolation valves (RGAV1-RGAV4); passby and dwell heater setpoints (HSP1-HSP8); power supply and

motor speed setpoints (PSSP1A-PSSP12B, DMOTLO1-DMOTLO21, DMOTHI1-DMOTHI21); the amount of time spent by a substrate in dwell heater chamber 14 (HTR1TMR); the amount of time the passby heater is on while a pallet is passing therethrough (HTR2ON_DLY); and an emergency stop and pause latch commands.

In addition, other elements such as coolant control, venting control, heater control, power supply control and cryo-pump system evacuation are manually initiated. Specifically, coolant control functions 3070 initiate coolant flow to heater shields 2230 and cathodes 2222-2225 in chambers 20, 26, and 28 upon manual power up of the system. Further, manual control is provided for some heater control functions 3075, such as selection of low and high heater setpoints. Manual control of the heater setpoints allows the user to monitor the output of the (Mikron) substrate temperature sensors and make adjustments to individual heater bank setpoints and/or substrate heating duration timers to achieve an optimal thermal effect on individual substrates moving through heater chambers 14 and 16. Additionally, manual control of some chamber vent functions 3015 allows for apparatus 10 to be vented in whole or in sections for machine maintenance.

Feedback block 3012 provides the user with such data as: argon pressure readout, substrate temperature, power supply output setpoints, motor speed setpoints, an ion & pirani gauge readouts. Additional data, such as that described above with respect to Figure 29, is also provided to the system operator.

Referring to Figure 30, apparatus 10 is generally maintained in a standby state 3028 at full vacuum, e.g., 1×10^{-7} Torr. At system standby 3028, apparatus 10 has been pumped down to a high vacuum level by mechanical

pumps MP1-MP3, blowers BL1-BL3 and cryopumps C1-C12. The system stand-by condition is usually maintained due to the time required to perform total system pumpdown.

As noted briefly above, system maintenance 3082 may be performed when apparatus 10 is on a section by section basis while venting only those sections necessary for maintenance purposes. In such cases, apparatus 10 is divided into five sections. Generally these sections comprise: chambers 12-14; chambers 18-24A; chambers 22B-24B; chambers 22D-24C; and chambers 29-30. Each of the five sections can be individually vented and pumped down under user control as required, depending on what access to apparatus 10 is required. In this regard, the chamber vent control functions 3015 allow the user to individually control of the opened or closed state of chamber vent valves CV1-CV5 depending on which section is to be vented. Automated section pump sequences 3010 are provided to control roughing down of each section 1-5 using pumps MP1-MP3 and blowers BL1-BL3, and high vacuum valves sequence 3030 to control valves HV1-HV12 as required, to reduce individual sections to high vacuum. Section pump sequence 3010 also ensures that doors D1-D12 are in their required opened or closed states with respect to the pumping or venting of the particular stage as required:

	DOORS CLOSED	
STAGE	PUMP	VENT
1	D1 - D3	D1 - D4
2	D4 - D6	D3 - D5
3	D5 - D8	D6 - D7
4	D7 - D10	D8 - D9
5	D9 - D12	D10 - D12

In the instance where chambers 12-30 of apparatus 10 have been fully vented and are at ambient atmosphere, an automated pump down sequence is provided to reduce the pressure of chambers 12-30 to approximately

50 mTorr. The user initiates the pump down system enable sequence 3020 which provides a check and setup for the pump-down process. A pump down timer PDSTMR is initialized which allows the pump down enable process to run for a maximum of 60 seconds before issuing a fault.

The enable process (PDSE) 3022 comprises: closing RV1-RV5; checking RVS1, RVS3, RVS5, RVS7, RVS9 to ensure valves RV1- RV5 are closed; enabling MP1-MP3; opening doors D2 - D11 (within a limit of 3 seconds before outputting a fault); closing doors D1 and D12; and enabling compressors CY1-CY8. A pirani gauge check 3024 is performed to ensure that PIR2, PIR6, PIR11, PIR16, and PIR15 are less than 125 mTorr (or equivalent preset level between 100-250 mTorr) before the system opens baffles 1210 and 1214. At this point, apparatus 10 has reached a roughed down state 3028 wherein each chamber 12-30 is at a pressure of approximately 50 mTorr, and blowers BL1-BL3 and mechanical pumps MP1-MP3 are disabled (3029).

To reduce the pressure in apparatus 10 to a level conducive to sputtering, high vacuum valves HV1-HV12 must be fully opened to allow cryogenic pumps C1-C12 to pump apparatus 10. This sequence 3030 is initiated by a manual user input 3030a assuming the system has reached the roughed, crossover point 3028. At stage 3030, pirani gauges PIR2, PIR6, PIR11, PIR16, and PIR15, corresponding to individual pump sections 1-5, are checked before opening each respective high vacuum valve sets HV1-HV2, HV3-HV5, HV6-HV8, HV9-HV11, and HV12, respectively associated therewith. Once high vacuum valves HV1-HV12 are opened, cryogenic pumps C1-C12 will evacuate the internal environment of chambers 12-30 to a pressure of approximately 1×10^{-7} - 2×10^{-7} Torr.

When apparatus 10 has achieved a pumped down state 3032, the auto run preparation mode 3034 must be initiated by a manual user input 3032a. Auto run preparation sequence 3034 involves: providing argon backfilling by opening GF3, GF5, GF7, and GF8; checking for no doorfaults ($\overline{\text{DOORFAULT}}$); check/enable mechanical pumps MP1 & MP3, and blowers BL1 and BL3; check and set dwell and passby heaters to low power setpoints; check and/or set doors D1-D3, D10-D12 closed, and doors D4-D9 open; and throttle HV2-HV12.

Once the system is prepared for auto run mode operation, a user input 3035 is required before the auto run mode 3050 is enabled. If the user input is made and the system is prepared, the auto mode is enabled. Auto mode functions 3050 include throttling high vacuum valves HV2-HV12 and enabling the transport stages of return conveyor path 50. In addition, auto mode 3050 includes the automatic run sequence 3200 controlling motor assemblies, door operation, load/exit lock pumping and venting, and high power supply/heat control described in Figure 32. Sputtering power supplies PS1A-PS12B will have been manually preset to low power. It is noteworthy that coolant control sensors CHR1A-CHR4B, MAG5A-MAG5B, and CAR9A-CAR12B must indicate the presence of circulating coolant in cathodes 2222-2225 before power supplies PS1A-PS12B will be enabled.

Upon exiting auto mode 3050, apparatus 10 returns to a standby state wherein the dwell and passby heaters in chambers 14 and 16, respectively, are automatically switched off and auto run mode is disabled.

The software also provides a number of fault flags to the user to allow the user to correct potential problems or to hold processing of other logic rungs until correction of the fault is completed. Such faults

may include, for example, argon gas flow failure detection (NO ARGON); a failure in communications between computer 2901 and programmable logic controller 2903 (NO FIX COMM); motor assembly faults; internal system pressure failures (NO VACUUM); cryogenic pump failures (CRYO > 20°K); load lock and exit lock venting problems (LLVENT > 60 s, EXLOCK VENT > 60s); open protective covers on sputtering chambers 20, 26, 28, (INTERLOCKS); mechanical pump and blower failures (MP FAIL); power supply arc (ARC DETECT); air supply failsafe (APS); heater alarm/fault; power supply setpoint alarms; door faults (DOORFAULT); valve faults; and coolant flow faults.

An automated process 3100 for regenerating (cleaning and purging) cryo pumps C1-C12 is also provided in the software of the present invention. Cryogenic pump regeneration process 3100 will be discussed with respect to Figure 31. Figure 31 is a flowchart showing the cryogenic pump regeneration process for a single cryogenic pump, C1. The regeneration processes for pumps C2-C12 are identical, using corresponding valves, gauges, and heaters, coupled to respective pumps C2-C12 as applicable, for each pump C2-C12 being regenerated.

In general, the cryogenic pump regeneration comprises raising the temperature of the cryogenic pumps, supplying the pumps with warm nitrogen, and enabling mechanical pump MP2 and blower BL2 to flush the contaminant materials agitated by the nitrogen flow out of the cryo pumps.

Cryogenic pump regeneration process 3100 is manually initiated by a user 3110. User initiation of the cryogenic pump regeneration process preferably enables simultaneous regeneration of all twelve cryogenic pumps 3115. The initial regeneration step 3120 entails

closing HV1 and initiating a sieve trap timer with a total duration of 5400 seconds.

The sieve timer initiates enables sieve heater SIVHTR1 for 3600 seconds (3121, 3122). Further, mechanical pump isolation valve MP2IV is checked and sieve valve SVIV1 is opened (3124) for a duration of 5400 seconds (3126); valve SVIV1 is closed at the expiration of 5400 seconds (3125). In addition, the purge sequence 3130 is initiated.

Purge sequence 3130 opens nitrogen flow valve NIF1 and enables nitrogen heater NIH1. Sequence 3130 waits until the cryogenic pump has reached a temperature of 290° K before initiating the purge timer with a duration of 7200 seconds. Purging of the cryogenic pump thereafter continues for 7200 seconds. When complete, NIF1 and NIH1 are closed and roughing sequence 3140 begins.

The roughing sequence involved initially checking to ensure that line pressure (PIR10) is TRUE, BL2 is enabled and PIR3 outputs false (pressure less than 250 mTorr). If these condition are met, cryo roughing valve CR1 and sieve valve SVIV1 are opened, and a roughing timer having a duration of 600 seconds is started. If roughing takes place for longer than 600 seconds a fault is generated. Otherwise, the system waits for PIR3 to output a TRUE condition before closing CR1.

After CR1 is closed, a ROR timer waits for 30 seconds to ensure PIR3 remains TRUE. If at any time before the expiration of thirty seconds a $\overline{\text{PIR3}}$ signal is received, the system counts one and returns to restart the roughing sequence. The system will perform ROR test 3150 generally for up to five cycles (and up to 20 cycles for pump C1) before outputting a fault.

If PIR3 remains TRUE and the ROR timer = 30 seconds, the process goes to cool down -- allowing 7200 seconds for the cryogenic pump to reach a temperature of ≤ 20°K. If the cryogenic pump does not reach 20° K within 7200 seconds, a fault is generated.

Figures 32A-32D are a logical diagram of one component of the electronic control system software showing input/output and process control of the auto run mode 3200 controlling substrate movement through apparatus 10. In the logical flow diagram of Figures 32A-32D, horizontal lines indicate software logic flow in relation to time, with time increasing in the direction of the arrows shown therein; vertical lines generally represent decision points.

As shown in Figures 32A and 32D, the system control software of the present invention utilizes motor control 2910, position sensors 2915, door control 2920 and pump valve and vent system 2930, to control movement of a substrate through sputtering apparatus 10. The addresses used in Figures 32A-32D correspond to those discussed above with respect to the functional elements of the electronic control system.

As shown in Figures 32A-32D, start point 3200 in entrance lock loop 3210 of the software represents a system status condition wherein sputtering apparatus 10 is prepared for a substrate to enter load lock 12. Start point 3200 may denote the first substrate entering apparatus 10, or may represent a point wherein a prior substrate cleared load lock 12 and passed into heater 14.

At the start point 3200, roughing valves RV1-R5 are closed, doors D4-D9 are open, doors D1-D3, D10-D12 are closed, and chamber vent valves CV1-CV5 are closed. The software also checks for a TRUE output from PIR17, RV5,

and DROP10S, indicating, respectively, chamber 30 at crossover pressure, the closed state of roughing valve RV5, and whether door D10 is open.

When a substrate is moved into position at entrance platform 210, the system software is prepared to begin entrance sequence 3210. Position sensors SEN1-SEN3 must indicate a TRUE condition, signaling the presence of a pallet, in order for the software system to proceed. If entrance lock loop 3210 is in a state wherein a substrate has passed out of dwell heater chamber 14, point 3215 in the logic flow line, timer VDDR2CL, which runs for 2 seconds to verify that door D2 has closed, must have completed its sequence in order for processing of that substrate to proceed. Generally, when VDDR2CL is initiated, a substrate will be waiting at entrance platform 210. Thus, input conditions indicated at 3212 will be TRUE and timer VDDR2CL will control initiation of the software logic. After the target position is verified, door close sensor DRCL1S is checked to ensure door D1 is closed, and roughing valve sensor RVS2 is checked to ensure roughing valve RV1 is closed. Additionally, pressure switch PS2 must read FALSE ($\overline{PS2}$), sensor SEN1 is redundantly checked for a TRUE output, and position sensors SEN4-SEN6 must read FALSE to ensure the absence of a substrate in load lock 12. When all the above-mentioned conditions are met, signal OPCV1 is directed to open chamber vent valve CV1 to vent load lock 12. In logical terms, the condition -- DRCL1S AND RVS1 AND $\overline{PS2}$ AND $\overline{SEN4}$ AND $\overline{SEN5}$ AND SEN6 -- must be TRUE to open CV1, as indicated by the input description 3212. Signal OPCV1 causes pressure switch PS2 to output a TRUE state, and pirani gauge PIR1 to output a FALSE state (e.g., pressure above crossover level).

A timer CV1_DLY runs for 1 second before a signal is sent to close CV2. Timer PAL_GAT_TT is a 155 second duration timer provided to ensure a specified amount of time passes between the entrance of successive pallets into load lock 12. Timer PAL_GAT_TT is initialized when door D1 is closed, as signified by $\overline{\text{DROP1}}$ or $\overline{\text{DROP1S}}$, such signals being generally output after door D1 is closed subsequent to entrance of a substrate into load lock 12, as shown by loop 3214. If PAL_GAT_TT is FALSE ($\overline{\text{PAL\_GAT\_TT}}$ e.g., timer complete), and PS2, SEN3, and SEN5, are TRUE then signal DROP1 is sent to open outer door D1 to receive a substrate into apparatus 10. Signal DROP1 will cause door open sensor DROP1S to output TRUE, indicating door D1 is, in fact, open. Prior to activating motor assemblies M3 and M4, the logical condition -- (SEN3 or SEN4) AND $\overline{\text{SEN6}}$ AND DRCL2S -- must be TRUE. When this condition is met, motor assemblies M3 and M4 are activated to move the substrate at high motor setpoint speed from entrance platform 210 of the sputtering apparatus into load lock 12. Movement of the substrate will cause sensors SEN4 and SEN6 to output TRUE, and sensors SEN1 and SEN3 to output FALSE. When sensors SEN3 and SEN6 output FALSE and TRUE conditions, respectively, signaling the presence of the substrate in chamber 14, signal DRCL1 is provided to close outer door D1. Signal DRCL1 causes DROP1S to output a FALSE condition indicating door D1 is closed, and enabling timer PAL_GTE_TT, as discussed above.

Subsequently position sensor SEN6, and door close sensors DRCL1S and DRCL2S, when TRUE, enable timer SOFRUF for 1 second, thereby delaying opening of roughing valve RV1. When timer SOFRUF has completed, and the logical condition -- DRCL1S, $\overline{\text{PIR1}}$, $\overline{\text{CV1}}$, BL1, AND

MPIIVOP -- is TRUE, signal OPRV1 is sent to open roughing valve RV1.

High speed, explosive pumping occurs in load lock 12 until such time as the preset requisite chamber pressure is achieved, causing PIR1 to output TRUE. Opening RV1 causes sensor RVS1 to output TRUE, enabling timer DROP2_DLY to run for two seconds to ensure pump MP1 and blower BL2 have sufficient time to pump load lock 12 down. When timer DROP2_DLY is done and PIR1 is TRUE, RVS1 outputs TRUE and PS2, FALSE. At the same time, signal OPTDR2 is sent to open door D2 to allow the substrate to move between load lock 12 and heater chamber 14.

Before motor assembly M4 will engage, sensor SEN6 must be TRUE, and SEN9 FALSE, to indicate the presence and absence of a target in load lock 12 and heater chamber 14, respectively. If all conditions are met, motor assembly M4 is activated at high speed setpoint; somewhat redundantly, the logical condition -- (SEN6 OR SEN7) AND $\overline{\text{SEN9}}$ -- must be TRUE in order for motor assembly M5 to engage at high speed. A substrate is thereby transferred between load lock 12 and heater chamber 14. The engagement of motor assembly M4 and M5 will cause sensors SEN7-SEN9 to output TRUE, and sensor SEN6 to become FALSE. Simultaneously, if the logical condition -- ($\overline{\text{SEN4}}$ OR SEN6) AND DR3CLS, SEN9, AND SEN7 -- is TRUE, signal DRCL2 will be sent to close door D2. Signal DRCL will cause sensor DRCL2S to become TRUE, thereby initiating timer VDDR2CL as discussed above.

At point 3215 in the logic diagram, the software and sputtering apparatus 10 are prepared to receive an additional substrate in load lock 12 while proceeding with the sputtering process on the substrate now present in heater chamber 14. Assuming position sensors SEN1

and SEN3 indicate the presence of a substrate, loop 3210 will return to start position 3200 and may continuously receive additional substrates while processing of other substrates continues at different points in apparatus 10 in accordance with the following discussion.

At this point, it is notable that the aforesaid redundant signal and sensor readings take on additional significance when multiple targets will be moving through the system. These fail safe sensor readings are provided to ensure smooth operation of apparatus 10, and the absence of pallet collisions or errors within the apparatus.

The substrate present in heater chamber 14 continues through apparatus 10 under the control of the system software as follows. Door close sensors DRCL2S and DRCL3S to ensure doors D2 and D3 are closed. Again, sensor SEN9 is checked to ensure the presence of a pallet in heater chamber 14. If all such conditions are true, HTR1TMR engages for 72 seconds; simultaneously, if no water faults are detected ($\overline{\text{HSFGIF}}$) heaters 1510A-1510D are driven to high power to act on the substrate present in chamber 14. Heating of the substrate in heater chamber 14 occurs for a specified duration as determined by HTR1TMR.

Upon completion of 72 seconds, two heater timers are initiated: HTRDLYTMR and HTR2ONDLY. If HTR1TMR is completed and no water faults are present ($\overline{\text{HSFGIF}}$), timer HTR2ONDLY, having a duration of 26 seconds, is enabled to control initiation of passby heaters 1818A-1818F and fault generation signal H2F upon its completion. Simultaneously HTRDLYTMR, having a duration of 25 seconds is enabled and measures out the substrate soak time in dwell heater chamber 14. Upon completion, timer HTRDLYTMR initiates the motor control and venting

sequence 3220 which runs simultaneously with heater control timing sequence 3225, generally illustrated in Figure 32B. After 25 seconds, baffle 1210 is throttled by signal HV1_2 and timer DR3DT, having a duration of 5 seconds, is initiated. If $\overline{\text{DROP3S}}$ is TRUE and timer DR3DT is done, signal DROP3 is provided to open door D3 to allow the substrate to pass from heater chamber 14 into first buffer/passby heater chamber 16.

As will be noted by following parallel processes 3220 and 3225, heater banks 1818A-1818E will have been initiated by HTR2ONDLY prior to the substrate's entry into chamber 16 and are timed to remain on until a point at which the substrate is exiting chamber 16. DROP3 will cause door open sensor DROP3S to indicate door D3 is in an open state. When the logical condition -- SEN9, $\overline{\text{SEN13}}$, $\overline{\text{SEN15}}$ AND DROP4S -- is TRUE, motor assembly M5 is enabled at slow setpoint speed. When the logical condition -- DROP4S, $\overline{\text{SEN12}}$ AND (SEN9 OR SEN10) -- is TRUE, motor assembly M6 is activated at slow setpoint speed to pass the substrate through from heater chamber 14 first to buffer passby heater chamber 16.

As the substrate is passed through chambers 14 and 16, SEN10-SEN13 will output TRUE and SEN7, FALSE. Subsequently, if the condition -- (SEN11 OR SEN12) AND DROP4S AND $\overline{\text{SEN15}}$ -- is TRUE, motor assembly M6 is enabled, and if -- (SEN12 OR SEN13) AND DROP4S AND $\overline{\text{SEN15}}$ -- is TRUE, motor assembly M7 is enabled at slow setpoint speed to pass the substrate from passby chamber 16 into dwell chamber 18. It will be noted that movement of the substrate into chamber 18 triggers SEN13, which in turn initiates timer HTR2OFF. HTR2OFF is set with a duration of 13 seconds, a period which, when used with the motor setpoint speeds set out above (Table 1), shuts off passby heaters 1818A-1818E before

the substrate fully exits chamber 16. This is to avoid overheating the trailing edge of the substrate, as discussed above. It is further noted that heater fault timer H2F runs for duration of 70 seconds before outputting a fault, indicating that the heater banks have been on too long, possibly resulting in burnout of the heating elements.

In like manner, movement of the substrate through sputtering apparatus 10 by motors M7-M19 continues as shown in Figs. 32C and 32D with associated inputs and outputs shown therein having like affect as the I/O discussed above. Each input condition shown must be met in order to activate subsequent motor assemblies along the substrate's path through sputtering apparatus 10. Likewise, each signal causes an output state change for each sensor or value indicated. In like manner, only those motor assemblies M6/M7, M7/M8, M8/M9, M9/M10, M10/M11, etc., necessary for particular platforms to transport the substrate present at that location are activated. Individual motor assembly speeds are set as discussed in Table 1 to vary the velocity of the substrate through particular chambers of sputtering apparatus 10 as the sputtering process requires. As noted with respect to Figures 32A-32D, and Table 1, motor assembly pairs operate at the same speed in order to assure smooth substrate transport.

As shown in Figure 32D, an exit lock loop 3250, similar to entrance lock loop 3210 discussed above, allows sequential passing of substrates through exit lock chamber 30 to ensure the integrity of the evacuated environment in sputtering apparatus 10 is maintained.

Beginning at point 3252, if -- DRCL10S, $\overline{\text{CV5}}$, $\overline{\text{SEN54}}$, AND RVS9 -- are TRUE, (indicating door D10 is closed, chamber vent CV5 is closed, substrate at SEN54, and

roughing valve RV5 is open, respectively), signal DROP11 is sent to open door D11, thereby causing sensor DROP11S to output TRUE. If -- (SEN51 OR SEN52) AND $\overline{\text{SEN54}}$ -- then, motor assemblies M19 and M20 are enabled at high setpoint speeds, causing SEN52-SEN54 to be TRUE and SEN51 to be FALSE. Sensor SEN54 enables a signal to close RV5, thereby causing RVS9 to output TRUE, and also enables a signal to close door DR11, causing DRCL11S to output TRUE. A delay timer VDDR11CL delays CV5's closing for 1 second to allow venting of exit lock 30. Once the above conditions are met, and sensor SEN54 is TRUE (pallet in exit lock 30) and DRCL12S is TRUE (door D12 closed), chamber vent CV5 is opened. Subsequently, if roughing valve RVS9 is shown as TRUE, sensor SEN57 indicates FALSE, door close sensor DRCL11S and sensor SEN54 indicate TRUE, and pressure switch PS6 indicates TRUE, exit lock 30 will be vented to atmosphere (opening CV5) and a signal DROP12 will be sent to open door 12, thereby resulting in door open sensor DROP12S outputting a TRUE condition. When pressure switch PS6 outputs a TRUE condition, timer CV5_DLY having a duration of 1 second, will be enabled. Timer CV5_DLY will, upon completion, output a signal to close chamber vent valve CV5.

Once door D12 is open, if sensor SEN54 is TRUE, sensor SEN57 output FALSE, and door sensor DRCL11S outputs TRUE, motor assembly M20 will be enabled to proceed at its fast speed setpoint. Simultaneously, if sensor SEN54 or SEN55 output TRUE, and sensor SEN57 outputs FALSE, motor M21 will be enabled to proceed at its fast setpoint. The substrate present in exit lock 30 will thereafter proceed to exit platform 214.

At point 3260 in the software logic flow, the software branches in two directions, enabling the

substrate to proceed to robot unloading station 45, if the logical condition -- SEN56 OR SEN57 -- is TRUE thereby enabling motor assembly M21 to proceed at its fast setpoint, or looping to prepare to receive an additional substrate in exit lock 30. To prepare to receive an additional substrate, chamber vent CV5 must be closed. Subsequently, sensor SEN54 must output FALSE and door close sensor DRCL11S output TRUE in order for a signal to be sent to close door D12. If the logical condition -- MP3IVOP, $\overline{\text{CV5}}$, BL3, $\overline{\text{PIR17}}$, $\overline{\text{SEN54}}$, AND DRCL11S -- is TRUE, a signal will be sent to open roughing valve RV5 to pump down chamber 30 to prepare for receiving an additional pallet therein. Opening roughing valve RV5 will cause roughing valve sensor RVS10 to output TRUE, and pirani gauge PIR17 will output TRUE when chamber 30 is below crossover. Apparatus 10 is then in a state which exists at software logic point 3252 to prepare to receive an additional substrate in exit lock 30.

As should be understood by those skilled in the art, the particular cross-over pumping levels described above with respect to the software of the present invention may be varied as desired to achieve the requisite atmospheric conditions in apparatus 10 for the particular sputtering application desired. In the preferred embodiment of the present invention, the pirani gauge pressure setpoints outputting digital signals to programmable logic controller 2902 are shown in Table 2:

TABLE 2

Gauge	Setpoints (in mTorr) Upper	Lower
PIR1	125	100
PIR2	125	100
PIR3	80	50
PIR4	80	50
PIR5	80	50
PIR6	125	100
PIR7	80	50
PIR8	80	50
PIR9	80	50
PIR10	1000	50
PIR11	125	50
PIR12	80	50
PIR13	80	50
PIR14	80	50
PIR15	150	125
PIR16	125	100
PIR17	125	100
PIR18	80	50
PIR19	80	50
PIR20	80	50

It should be further understood by those skilled in the art that a multitude of control schemes and sensor I/O arrangements may be utilized within the scope of the present invention to provide an automated control sequence over a substrate or substrates moving through a sputtering apparatus in accordance with the present invention. The above-described automated run mode 3200 provides for a multitude of pallets, optimally seven pallets, moving through apparatus 10 as discussed in the present specification. It should be understood that all such modifications are contemplated as being within the scope of the invention described herein.

L. Process In General

Examples 1 and 2 illustrate process parameters for sputtering apparatus 10 to produce 950 Oe and 1200 Oe, respectively, hard drive disks.

Example 1

As illustrated in Figure 2, once engaged by substrate carrier 1450, pallet 800 loaded with disk substrates 510 proceeds through door D1 into load lock chamber 12. After pallet 800 enters load lock chamber 12, door D1 closes. Load lock chamber 12 is pumped down to 50 microns (50 mTorr) in 20 seconds by mechanical roughing pump MP1. Door D2 opens, allowing pallet 800 to proceed at 6 ft/min into dwell heating chamber 14. Dwell heating chamber 14 has already been evacuated by cryo pump C1 to 10^{-5} Torr (0.01 microns). As pallet 800 proceeds through the chamber, it triggers proximity position sensors which in turn initiate heaters. Heating lamp warmup time is negligible since, during sputtering operations, the lamp filaments are kept warm by a low power level. Pallet 800 and disk substrates 510 soak in dwell heating chamber 14 for 30 seconds with the temperature about 220°C. During this soak period, the heating power applied is 3.1 kW per bank. Argon enters through gas manifolds to backfill dwell heating chamber 14 and equalize the internal pressure before door D3 opens, allowing pallet 800 to proceed. This backfill also maintains pressure equilibrium throughout the apparatus, essential to stabilizing sputtering processes. Door D3 opens to passby heating chamber 16, triggering the initiation of passby heaters. Pallet 800 enters passby heating chamber 16 and after clearing sensor SEN10, triggers the closure of door D3. This chamber also has been evacuated by cryo pump C2 to about 10^{-5} Torr (0.01 microns). Passby heating banks 1818A-1818F operate using 7.6 kW per bank. Lamps 1514 on the leading edge of the pallet reduce power as pallet 800 exits into dwell chamber 18 at 6 ft/min. Pallet 800 proceeds through dwell chamber 18 which has already been

evacuated by cryo pump C3 to 10^{-5} Torr. The pallet proceeds at 6 ft/min past heat reflective panels 2120.

Pallet 800 enters chromium sputtering chamber 20 maintained at 9-12 microns (9-12 mTorr) of argon pressure with argon flow at 300 standard cubic centimeters per minute (sccm). Pallet 800 travels at 6 ft/min as it passes sputtering targets 2226-2229. The sputtering power is 7.5 kW per cathode, with a 1,000 Å thick chromium film deposited. Transport speed through dwell chamber 22A, buffer chamber 24A and dwell chamber 22B is 12 ft/min through open doors D5 and D6. These three chambers are pumped by cryo pumps C4, C5, and C6. Pallet 800 enters magnetic sputtering chamber 26 maintained at 9-12 microns [9-12 mTorr) of argon by cryo pumps C6 and C7 with argon flow at approximately 400 sccm. The transport speed through sputtering chamber 26 is 6 ft/min. The sputtering power is 7.5 kW per cathode, depositing a 800 Å thick CoCrTa film. Transport speed through dwell chambers 22C and 22D and buffer chamber 24B is 6 ft/min. Dwell chambers 22C, 22D and buffer chamber 24B are pumped by cryo pumps C7, C8 and C9. Pallet 800 enters carbon sputtering chamber 28 maintained at 9-10 microns (9-12 mTorr) by cryo pumps C9 and C10 with argon and up to 15% hydrocarbon gas like ethylene or acetylene flowing at 100 sccm. The transport speed is 2.8 ft/min as the pallet passes the sputtering targets in carbon sputtering chamber 28. Sputtering power is 7 kW per cathode with a film thickness of 350 Å. Transport speed through dwell chamber 22E, buffer chamber 24C and exit buffer chamber 29 is 6 ft/min with doors D9 and D10 opening and closing sequentially to allow pallet 800 to proceed. Dwell chamber 22E is pumped by cryo pumps C10 and C11, buffer chamber 24C and exit buffer chamber 29 are pumped by

cryo pump C12. Argon is backfilled into exit buffer chamber 29 by cryo pump C12 to equalize the pressure differential existing with respect to exit lock chamber 30. Pallet 800 next proceeds through exit lock chamber 30 which is vented to the atmosphere by chamber vent valve CV5 in 10 seconds. Pallet 800 then proceeds to robotic unloading station 45.

To produce a 1,200 Oe magnetic film, the soak time in dwell heating chamber 14 may be increased to about 50 seconds to allow the substrate temperature to increase to approximately 250°C and/or the pallet transport speed through chromium sputtering chamber 20 may be reduced in order to allow a thicker deposition of a chromium underlayer. Adjustment of soak time and/or substrate temperature parameters depends on the life cycle of the pallet -- a pallet which has proceeded through numerous sputtering runs will have a thicker film deposition which can absorb more water and consequently would have more water to outgas before film deposition.

The many features and advantages of the apparatus and process of the present invention will be apparent to those skilled in the art from the description of the preferred embodiments and the drawings.

Thus, a high throughput process and apparatus which accomplishes the objectives of the invention and provides the above advantages by providing a comprehensive in-line sputtering system utilizing matched component elements to process multiple large single sheet or pallet transported discrete substrates in a continuous, variable speed, sputtering process has been described. Such an apparatus and method can process up to 3,000 95mm disk substrates, and 5,300 65mm disk substrates, per hour. Such high volume production offers both high volume production and, consequently,

cost savings per disk on the order of $4.00 per disk over prior art sputtering apparatus and processes. As noted throughout this specification, such an apparatus and process is achieved through a novel combination of process and structural elements involved in disk preparation, provision of a sputtering environment, transportation of substrates through the sputtering environment at rapid speeds and in a contaminant free manner, heating the substrates to optimal thermal levels for sputtering, and sputtering the substrates through a series of substantially isolated, non-crosscontaminating sputtering steps.

SECTION M

110

Number of Program Files

Name	File	Sub-Program Description	Size: Elems	Bytes
	0	[SYSTEM DATA STORAGE HEADER]	32	64
MAIH_PRGRM	2	THE MAIN PROGRAM	7205	36456
CRYO_REGEN	3	CRYO REGENERATION RUNGS	1942	10475
RETRN_CNVR	4	THE RETURN CONVEYOR	550	2683
FAULTS	5	THE FAULT RUNGS	798	5114
TECH_RUNGS	6	THE TECHNICIAN RUNGS	370	2578

```
Rung #000
|FIRST SCAN                                                            FIRST SCAN   |
|AFTER POWER                                                           AFTER POWER  |
|LOSS                                                                  LOSS         |
|1ST_PASS                                                              PWR_ON_DLY   |
|      S:1                                                                  B3      |
|------| |-----------------------------------------------------------------(L)------|
|      15                                                                  444      |
B3/444 - -| |- - File #2 MAIN_PRGRM -  155
         -|/|- - File #2 MAIN_PRGRM -  115,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138
         -(L)- - File #2 MAIN_PRGRM -  0
         -(U)- - File #2 MAIN_PRGRM -  1
Rung #001
|
|POWER ON DELAY                                                        FIRST SCAN   |
|DEFEAT                                                                AFTER POWER  |
|PWR_ON_DLY_DFT                                                        LOSS         |
|      B3                                                              PWR_ON_DLY   |
|------| |-----------------------------------------------------------------B3       |
|      268                                                                -(U)------|
                                                                           444      |
B3/444 - -| |- - File #2 MAIN_PRGRM -  155
         -|/|- - File #2 MAIN_PRGRM -  115,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138
         -(L)- - File #2 MAIN_PRGRM -  0
         -(U)- - File #2 MAIN_PRGRM -  1
Rung #002
|BLOCK TRANSFER  BLOCK TRANSFER                       BLOCK TRANSFER                 |
|WRITE           READ                                 WRITE ENABLE                   |
|BT_WRITE        BT_READ                              BTWRITE                        |
|     N11:1          N10:0                            +-BTW--------------------+     |
|------|/|-----------|/|------------------------------+BLOCK TRANSFER WRITE    +-(EN)-|
|      15             15                              |Mod Type:        1771-DB|     |
|[2]             [3]                                  |          BASIC module +-(DN) |
|                                                     |Rack:                  4|     |
|                                                     |Group:                 7+-(ER) |
|                                                     |Module:                0|     |
|                                                     |Control Block:     N11:1|     |
|                                                     |Data File:         N7:21|     |
|                                                     |LENGTH:               21|     |
|                                                     |Continuous:            N|     |
|                                                     +------------------------+     |
N11:1/15 - -|/|- - File #2 MAIN_PRGRM -  2,3
N7:21/3 - -( )- - File #2 MAIN_PRGRM -  532
N7:21/4 - -( )- - File #2 MAIN_PRGRM -  533
N7:21/5 - -( )- - File #2 MAIN_PRGRM -  534
N7:21/6 - -( )- - File #2 MAIN_PRGRM -  535
N7:21/7 - -( )- - File #2 MAIN_PRGRM -  536
N7:21/8 - -( )- - File #2 MAIN_PRGRM -  537
N7:21/9 - -( )- - File #2 MAIN_PRGRM -  538
N7:21/10 - -( )- - File #2 MAIN_PRGRM -  539
N7:21/11 - -( )- - File #2 MAIN_PRGRM -  540
N7:21/12 - -( )- - File #2 MAIN_PRGRM -  541
N7:21/13 - -( )- - File #2 MAIN_PRGRM -  542
N7:21/14 - -( )- - File #2 MAIN_PRGRM -  543
N7:21/15 - -( )- - File #2 MAIN_PRGRM -  544
```

```
Rung #003
|BLOCK TRANSFER  BLOCK TRANSFER                                          BLOCK TRANSFER
|WRITE           READ                                                    READ ENABLE
|BT_WRITE        BT_READ                                                 BTREAD
|    W11:1          W10:0                                               ┌─BTR─────────────────┐
├───┤/├──────────┤/├────────────────────────────────────────────────────┤BLOCK TRANSFER READ  ├─(EN)─┤
|     15            15                                                   |Mod Type:     1771-DB|
|[2]             [3]                                                     |        BASIC module├─(DN)
|                                                                        |Rack:              4|
|                                                                        |Group:             7├─(ER)
|                                                                        |Module:            0|
|                                                                        |Control Block: W10:0|
|                                                                        |Data File:      W7:0|
|                                                                        |LENGTH:           21|
|                                                                        |Continuous:        N|
|                                                                        └────────────────────┘
W10:0/15 - ┤/├ - File #2 MAIN_PRGRM -  2
W7:0/3 - ┤ ├ - File #2 MAIN_PRGRM -  551
W7:0/4 - ┤ ├ - File #2 MAIN_PRGRM -  552
W7:0/5 - ┤ ├ - File #2 MAIN_PRGRM -  553
W7:0/6 - ┤ ├ - File #2 MAIN_PRGRM -  554
W7:0/7 - ┤ ├ - File #2 MAIN_PRGRM -  555
W7:0/8 - ┤ ├ - File #2 MAIN_PRGRM -  556
W7:0/9 - ┤ ├ - File #2 MAIN_PRGRM -  557
W7:0/10 - ┤ ├ - File #2 MAIN_PRGRM -  558
W7:0/11 - ┤ ├ - File #2 MAIN_PRGRM -  559
W7:0/12 - ┤ ├ - File #2 MAIN_PRGRM -  560
W7:0/13 - ┤ ├ - File #2 MAIN_PRGRM -  561
W7:0/14 - ┤ ├ - File #2 MAIN_PRGRM -  562
W7:0/15 - ┤ ├ - File #2 MAIN_PRGRM -  563
```

```
Rung #004
|                                                                        OSCILLATOR
|OSCILLATOR                                                              TIMER 1
|OSC                                                                     OSC_TMR1
|    B3                                                                 ┌─TON─────────────┐
├───┤/├─────────────────────────────────────────────────────────────────┤TIMER ON DELAY   ├─(EN)─┤
|    142                                                                 |TIMER:     T4:184|
|[6]                                                                     |BASE (SEC):  0.01├─(DN)
|                                                                        |PRESET:        50|
|                                                                        |ACCUM:          0|
|                                                                        └─────────────────┘
T4:184.DN - ┤ ├ - File #2 MAIN_PRGRM -  6
```

```
Rung #005
|                                                                        OSCILLATOR
|OSCILLATOR                                                              TIMER 2
|OSC                                                                     OSC_TMR2
|    B3                                                                 ┌─TON─────────────┐
├───┤ ├─────────────────────────────────────────────────────────────────┤TIMER ON DELAY   ├─(EN)─┤
|    142                                                                 |TIMER:     T4:185|
|[6]                                                                     |BASE (SEC):  0.01├─(DN)
|                                                                        |PRESET:        50|
|                                                                        |ACCUM:         48|
|                                                                        └─────────────────┘
T4:185.DN - ┤ ├ - File #2 MAIN_PRGRM -  7
```

```
Rung #006
|                                                                               OSCILLATOR
|OSC_TMR1                                                                       OSC
| T4:184                                                                            B3
├───┤ ├─────────────────────────────────────────────────────────────────────────(L)────┤
|    DN                                                                            142
|[4]
B3/142 - ┤ ├ - File #2 MAIN_PRGRM -  5,624
```

```
        -|/|- - File #2 MAIN_PRGRM -
        -(L)- - File #2 MAIN_PRGRM -  6
        -(U)- - File #2 MAIN_PRGRM -  7
Rung #007
|                                                                   OSCILLATOR |
|OSC_TMR2                                                           OSC        |
| T4:185                                                              B3       |
|--| |--------------------------------------------------------------(U)--------|
|   DN                                                                142      |
|[5]                                                                           |
B3/142 - -| |- - File #2 MAIN_PRGRM -  5,624
        -|/|- - File #2 MAIN_PRGRM -  4
        -(L)- - File #2 MAIN_PRGRM -  6
        -(U)- - File #2 MAIN_PRGRM -  7
Rung #008
|OSCILLATOR                                          OSCILLATOR                 |
|2                                                   TIMER 3                    |
|OSC2                                                OSC_TMR3                   |
|    B3                                              +-TON-----------------+    |
|---|/|----------------------------------------------|TIMER ON DELAY       |-(EN)-|
|   143                                              |TIMER:        T4:186 |    |
|[10]                                                |BASE (SEC):     0.01 |-(DN) |
|                                                    |PRESET:          200 |    |
|                                                    |ACCUM:           166 |    |
|                                                    +---------------------+    |
T4:186.DN - -| |- - File #2 MAIN_PRGRM -  10
Rung #009
|OSCILLATOR                                          OSCILLATOR                 |
|2                                                   TIMER 4                    |
|OSC2                                                OSC_TMR4                   |
|    B3                                              +-TON-----------------+    |
|---| |----------------------------------------------|TIMER ON DELAY       |-(EN)-|
|   143                                              |TIMER:        T4:187 |    |
|[10]                                                |BASE (SEC):     0.01 |-(DN) |
|                                                    |PRESET:          200 |    |
|                                                    |ACCUM:             0 |    |
|                                                    +---------------------+    |
T4:187.DN - -| |- - File #2 MAIN_PRGRM -  11
Rung #010
|                                                                   OSCILLATOR |
|                                                                   2          |
|OSC_TMR3                                                           OSC2       |
| T4:186                                                              B3       |
|--| |--------------------------------------------------------------(L)--------
|   DN                                                                143
|[8]
B3/143 - -| |- - File #2 MAIN_PRGRM -  9,624
        -|/|- - File #2 MAIN_PRGRM -  8
        -(L)- - File #2 MAIN_PRGRM -  10
        -(U)- - File #2 MAIN_PRGRM -  11
Rung #011
|                                                                   OSCILLATOR |
|                                                                   2          |
|OSC_TMR4                                                           OSC2       |
| T4:187                                                              B3       |
|--| |--------------------------------------------------------------(U)--------|
|   DN                                                                143      |
|[9]                                                                           |
B3/143 - -| |- - File #2 MAIN_PRGRM -  9,624
        -|/|- - File #2 MAIN_PRGRM -  8
        -(L)- - File #2 MAIN_PRGRM -  10
        -(U)- - File #2 MAIN_PRGRM -  11
```

```
Rung #012
|                                                              MOTOR DRIVE          |
|                                                              PULSER               |
|                                                              TIMER B              |
|MDPTA                                                         MDPTB                |
|T4:298                                                        +-TON--------------+ |
|--|/|---------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|   DN                                                         |TIMER:      T4:299| |
|[13]                                                          |BASE (SEC):   0.01+-(DN) |
|                                                              |PRESET:          5| |
|                                                              |ACCUM:           6| |
|                                                              +------------------+ |
T4:299.DN - -| |- - File #2 MAIN_PRGRM -   13,14,184,189,194
Rung #013
|                                                              MOTOR DRIVE          |
|MOTOR START                                                   PULSER               |
|PULSE                                                         TIMER A              |
|MDPTB                                                         MDPTA                |
|   T4:299                                                     +-TON--------------+ |
|-----| |------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|       DN                                                     |TIMER:      T4:298| |
|[12]                                                          |BASE (SEC):   0.01+-(DN) |
|                                                              |PRESET:          5| |
|                                                              |ACCUM:           3| |
|                                                              +------------------+ |
T4:298.DN - -|/|- - File #2 MAIN_PRGRM -   12
Rung #014
|MOTOR START                                                          MOTOR DRIVE  |
|PULSE                                                                PULSER       |
|MDPTB                                                                MDP          |
|   T4:299                                                                B3       |
|-----| |---------------------------------------------------------------( )--------|
|       DN                                                               299       |
|[12]                                                                              |
B3/299 - -| |- - File #2 MAIN_PRGRM -   217,230,248,252,257,262,280,284,289,294,305,309,314,319,330,354
        -( )- - File #2 MAIN_PRGRM -   14
Rung #015
|              PALLET       PALLET                                                 |
|  AUTO        DETECTED     DETECTED                                  ENTER        |
|  MODE        LEFT SIDE    RIGHT SIDE                                PRODUCTION   |
|  ENABLE      ENTRANCE     ENTRANCE                                  SYSTEM       |
|  AUTO        SEN1         SEN3                                      LLIN         |
|   N7:37        I:003        I:003                                     O:007      |
|--+--| |--+-----|/|----------|/|---------------------------------------( )--------|
|  |    11  |      00           02                                       15        |
|  |[155]   |                                                                      |
|  |MOTOR 3 |                                                                      |
|  |SLOW    |                                                                      |
|  |M3S     |                                                                      |
|  |  O:013 |                                                                      |
|  +---| |--+                                                                      |
|       02                                                                          |
|  [187]                                                                           |
Rung #016
|SUSPEND                                                              SUSPEND      |
|OPERATION                                                            OPERATION    |
|ENABLE                                                               LATCH        |
|SUSOPE                                                               SUSOPL       |
|  N7:18                                                                B3         |
|-----| |---------------------------------------------------------------(L)--------|
|      0                                                                101         |
|[3]                                                                               |
```

```
B3/101 - -|/|- - File #4 RETRN_CNVR -     ,60
         -(L)- - File #2 MAIN_PRGRM -  16
         -(U)- - File #2 MAIN_PRGRM -  17
Rung #017
|                                                              SUSPEND   |
| PREPARE FOR                                                  OPERATION |
| AUTO RUN                                                     LATCH     |
| >AUTO                                                        SUSOPL    |
|     N7:37                                                        B3    |
|-+---| |---+---------------------------------------------------(U)-----|
| |       1   |                                                   101    |
| |[157]      |                                                          |
| |           | B3/101 - -|/|- - File #4 RETRN_CNVR - 59, 60             |
| |           |          -(L)- - File #2 MAIN_PRGRM - 16                 |
| |COMPUTER   |                                                          |
| |SIGNAL FOR |                                                          |
| |AUTO MODE  |                                                          |
| |OK         |                                                          |
| |COMPAUTO   |                                                          |
| |   N7:16   |                                                          |
| +----| |----+                                                          |
|       11                                                               |
|  [3]                                                                   |
Rung #018
|PALLET
|DETECTED                                                    PALLET
|RIGHT SIDE                                                  WAITING AT
|EXIT END                                                    MINT EXIT  |
|SEN57                                                       PWAME      |
|   I:054                                                      O:057    |
|-----| |-------------------------------------------------------( )------|
|     17                                                         14     |
Rung #019
|REGENERATE                                                 HIVAC CLOSE |
|ALL CRYO'S                                                 STAGGER     |
|TS20                                                       HVCL_STAG   |
|   N7:16                                                        B3      |
|-----| |-------------------------------------------------------(L)------|
|     12                                                        280      |
|[3]                                                                    |
B3/280 - -| |- - File #2 MAIN_PRGRM -  20
         -(L)- - File #2 MAIN_PRGRM -  19
         -(U)- - File #2 MAIN_PRGRM -  21
Rung #020
|HIVAC CLOSE                                        HIVAC STAGGER
|STAGGER                                            TIMER
|HVCL_STAG                                          HI_STAG
|     B3                                            +--TON-----------+        |
|-----| |-------------------------------------------+TIMER ON DELAY  +-(EN)-|
|     280                                           |TIMER:   T4:197|        |
|[19]                                               |BASE (SEC):  1.0+-(DN)  |
|                                                   |PRESET:      35|        |
|                                                   |ACCUM:        0|        |
|                                                   +---------------+        |
T4:197.ACC - GEQ - File #3 CRYO_REGEN -  34,38,42,46,52,53,57
T4:197.DN - -| |- - File #2 MAIN_PRGRM -  21
                    File #3 CRYO_REGEN -  63
```

```
Rung #021
| ABORT CRYO                                                   HIVAC CLOSE |
| REGENERATION                                                 STAGGER     |
| BT_CR                                                        HVCL_STAG   |
|      N7:17                                                       B3      |
|-+----] [----+-------------------------------------------------(U)-------|
| |      9    |                                                   280      |
| |[3]        |                                                            |
| |           | B3/280 - -] [- - File #2 MAIN_PRGRM - 20                   |
| |           |        -(L)- - File #2 MAIN_PRGRM - 19                     |
| |HI_STAG    |                                                            |
| | T4:197    |                                                            |
| |---] [-----|                                                            |
| |    DN     |                                                            |
| |[20]       |                                                            |
| |ABORT CRYO |                                                            |
| |REGEN ENABLE                                                            |
| |ABORTCRGN  |                                                            |
| |     B3    |                                                            |
| +----] [----+                                                            |
|      297                                                                 |
|  [3:26]                                                                  |
Rung #022
| SYSTEM IS                                                 PUMPDOWN      |
| PUMPED                                                    SYSTEM        |
| DOWN                                                      ENABLE        |
| SYS_PD                                                    PDSE          |
|      B3                                                       B3        |
|-+----] [----+-----------------------------------------------+-(U)-+--+--|
| |     389   |                                               |  303|  |  |
| |[140]      |                                               |     |  |  |
| |           | B3/303 - -] [- - File #2 MAIN_PRGRM - 24, 25, 26, 27, 28, 29, 30, 31, 32,
| |           |        33, 46, 47, 48, 49, 68, 73, 78, 104, 140, 183, 200,
| |           |        216, 324, 326, 327, 353, 415
| |           |      -]/[- - File #2 MAIN_PRGRM - 369, 405, 411, 418, 425, 430
| |           |      -(L)- - File #2 MAIN_PRGRM - 23
| |           |                                               |MANUAL |  |  |
| |           |                                               |SYSTEM |  |  |
| |           |                                               |PUMPDOWN  |  |
| |           |                                               |ENABLE |  |  |
| |           |                                               |MSPE   |  |  |
| |ABORT PUMPDOWN N7:36/8 - -(L)- - File #2 MAIN_PRGRM - 23      | N7:36 |  |
| |BT_PD      | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2   +-(U)--+  |  |
| |    N7:17  | T4:285.TT - -] [- - File #2 MAIN_PRGRM - 84, 91, 98       8  |  |
| |----] [----|                                               |        |  |
| |     8     |                                               |PUMPDOWN|  |
| |[3]        |                                               |SEQUENCE|  |
| |           |                                               |DISABLE |  |
| |           |                                               |PULSE   |  |
| |           |                                               |PDSDPLSE|  |
| |PIRINI     |                                               |+-TON-----------+  |
| |GUAGE NO   |                                               +|TIMER ON DELAY |-(EN)-+
| |FAULT      |                                                |TIMER:   T4:285|
| |PGNF       |                                                |BASE (SEC):  1.0|-(DN)
| |     B3    |                                                |PRESET:       5|
| |---]/[-----|                                                |ACCUM:        0|
| |   465     |                                                +---------------+
| |[5:205]    |
| |PREPARE FOR|
| |AUTO RUN   |
| |>AUTO      |
| |   N7:37   |
| +----] [----+
|       1
|  [157]
```

```
Rung #023
|            PIRINI                         SYSTEM
|START       GUAGE NO   NO CRYOS BEING      VENT      VENT AREA   VENT AREA   VENT AREA   VENT AREA   VENT AREA                PUMPDOWN |
|PUMPDOWN    FAULT      REGENERATED         ENABLE    1 ENABLE    2 ENABLE    3 ENABLE    4 ENABLE    5 ENABLE                 SYSTEM   |
|TS00        PGNF       NO_CYRGN            SYSVNTE   VENT1E      VENT2E      VENT3E      VENT4E      VENT5E                   ENABLE   |
| N7:15      B3              B3             N7:37     N7:37       N7:37       N7:37       N7:37       N7:37                    PDSE     |
|                                                                                                                                 B3       |
|--] [-------] [-----------] [-------------]/[--------]/[--------]/[---------]/[---------]/[---------]/[-------------------------+--(L)--+-|
|   8        465            233             5          6           7            8           9           10                     |  303  | |
|[3]       [5:205]    [3:33]              [368]      [405]       [411]       [418]       [425]       [430]                     |       | |
|                                                                                                                                |       | |
| B3/303 - ] [ - File #2 MAIN_PRGRM - 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 46, 47, 48, 49, 68,                                |MANUAL | |
|                  73, 78, 104, 140, 183, 200, 216, 324, 326, 327, 353, 415                                                     |SYSTEM | |
|            ]/[ - File #2 MAIN_PRGRM - 369, 405, 411, 418, 425, 430                                                           |PUMPDOWN |
|            -(U)- - File #2 MAIN_PRGRM - 22                                                                                    |ENABLE | |
| N7:36/8 - -(U)- - File #2 MAIN_PRGRM - 22                                                                                    |MSPE   | |
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                                                                  | N7:36 | |
|                                                                                                                                +--(L)--+ |
Rung #024                                                                                                                           8      |
|          LLOCK      DWELL 2    DWELL 4    DWELL 5    EXLOCK
|          CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER                                                                           |
|PUMPDOWN  ROUGH      ROUGH      ROUGH      ROUGH      ROUGH                                                                             |
|SYSTEM    VALVE      VALVE RV2  VALVE      VALVE      VALVE                                                             RV'S ALL       |
|ENABLE    CLOSED     CLOSED     CLOSED     CLOSED     CLOSED                                                            CLOSED FOR     |
|PDSE      RVS1       RVS3       RVS5       RVS7       RVS9                                                              CROSSOVER      |
|  B3      I:002      I:022      I:036      I:052      I:052                                                             RVS_CLOSED     |
|                                                                                                                           B3          |
|--] [-------] [--------] [--------] [--------] [--------] [------------------------------------------------------------------( )-------|
|  303       15         15         15         14         16                                                                176          |
|[23]
B3/176 - ] [ - File #2 MAIN_PRGRM - 105,106,107,108,109
         -( )- - File #2 MAIN_PRGRM - 24
Rung #025
|PUMPDOWN
|SYSTEM                                                                                              PUMPDOWN                    |
|ENABLE                                                                                              SYSTEM                      |
|PDSE                                                                                                TIMER                       |
|  B3                                                                                                PDSTMR                      |
|                                                                                                    +-TON----------------+      |
|--] [-----------------------------------------------------------------------------------------------+TIMER ON DELAY      +-(EN)-|
|  303                                                                                               |TIMER:       T4:190 |      |
|[23]                                                                                                |BASE (SEC):     1.0 +-(DN) |
|                                                                                                    |PRESET:         600 |      |
|                                                                                                    |ACCUM:            0 |      |
|                                                                                                    +--------------------+      |
T4:190.DN - ] [ - File #2 MAIN_PRGRM - 609
```

Rung #026

```
|                                                                                      ENABLE
| PUMPDOWN                                                                             CRYO
| SYSTEM                                                                               COMPRESSOR
| ENABLE                                                                               1
| PDSE                                                                                 CY1
|    B3                                                                                  O:010
|---] [----+----------------------------------------------------------------------+-----(L)-----+--|
|    303   |                                                                      |     04      |
|[23]      |                                                                      |MANUAL       |
|          | O:010/04 - -] [- - File #2 MAIN_PRGRM - 436                          |CONTROL      |
|          |                    File #3 CRYO_REGEN - 260                          |CRYO           MANUAL CRYO
|          |                    File #6 TECH_RUNGS - 19                           |COMPRESSOR     COMPRESSOR 1
|          |              -(U)- - File #3 CRYO_REGEN - 6                          |2 ENABLE       RUN
|COOL DOWN | N7:34/5 - -(U)- - File #3 CRYO_REGEN - 6                            |M-CY1-1        MCYC1RUN
|1         | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                         |  N7:13           N7:34
|CD1       | N7:29/5 - -(L)- - File #3 CRYO_REGEN - 6                            +---] [---+------(L)----+
|   B3     | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                              5    |       5
|---] [----+                                                                      [3]     |
|   651    |                                                                              |MANUAL CRYO
|[3:20]    |                                                                              |COMPRESSOR 1
|          |                                                                              |STOP
|          COMPRESSOR                                                                     |MCYC1STOP
|          1 REGEN-                                                                       |   N7:29
|PUMP AREA ERATION                                                                        +----(U)----+
|1 ENABLE  PROGRAM                                                                              5
|PUMP1E    CYRGN1
|  N7:37     B3
|---] [------]/[---+
|   13       321   |
|[434]     [3:0]   |
|MANUAL            |
|CONTROL           |
|CRYO              |
|COMPRESSOR        |
|2 ENABLE          |
|M-CY1-1           |
|  N7:13           |
|---] [------------+
|   5
| [3]
```

Rung #027

PUMPDOWN
SYSTEM
ENABLE
PDSE
B3
303
[23]

COOL DOWN
2
CD2
B3
652
[3:203]

PUMP AREA
1 ENABLE
PUMP1E
N7:37
13
[434]

COMPRESSOR
2 REGEN-
ERATION
PROGRAM
CYRGN2
B3
322
[3:34]

PUMP AREA
2 ENABLE
PUMP2E
N7:37
14
[438]

MANUAL
CONTROL
CRYO
COMPRESSOR
2 ENABLE
M-CY2-1
N7:13
6
[3]

0:010/05 - -| |- - File #2 MAIN_PRGRM - 436, 440
File #3 CRYO_REGEN - 260
File #6 TECH_RUNGS - 19
-(U)- - File #3 CRYO_REGEN - 81
N7:34/6 - -(U)- - File #3 CRYO_REGEN - 81
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/6 - -(L)- - File #3 CRYO_REGEN - 81
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

ENABLE
CRYO
COMPRESSOR
2
CY2
0:010
-(L)-
05

MANUAL
CONTROL
CRYO
COMPRESSOR
2 ENABLE
M-CY2-1
N7:13
6
[3]

MANUAL CRYO
COMPRESSOR 2
RUN
MCYC2RUN
N7:34
-(L)-
6

MANUAL CRYO
COMPRESSOR 2
STOP
MCYC2STOP
N7:29
-(U)-
6

Rung #028

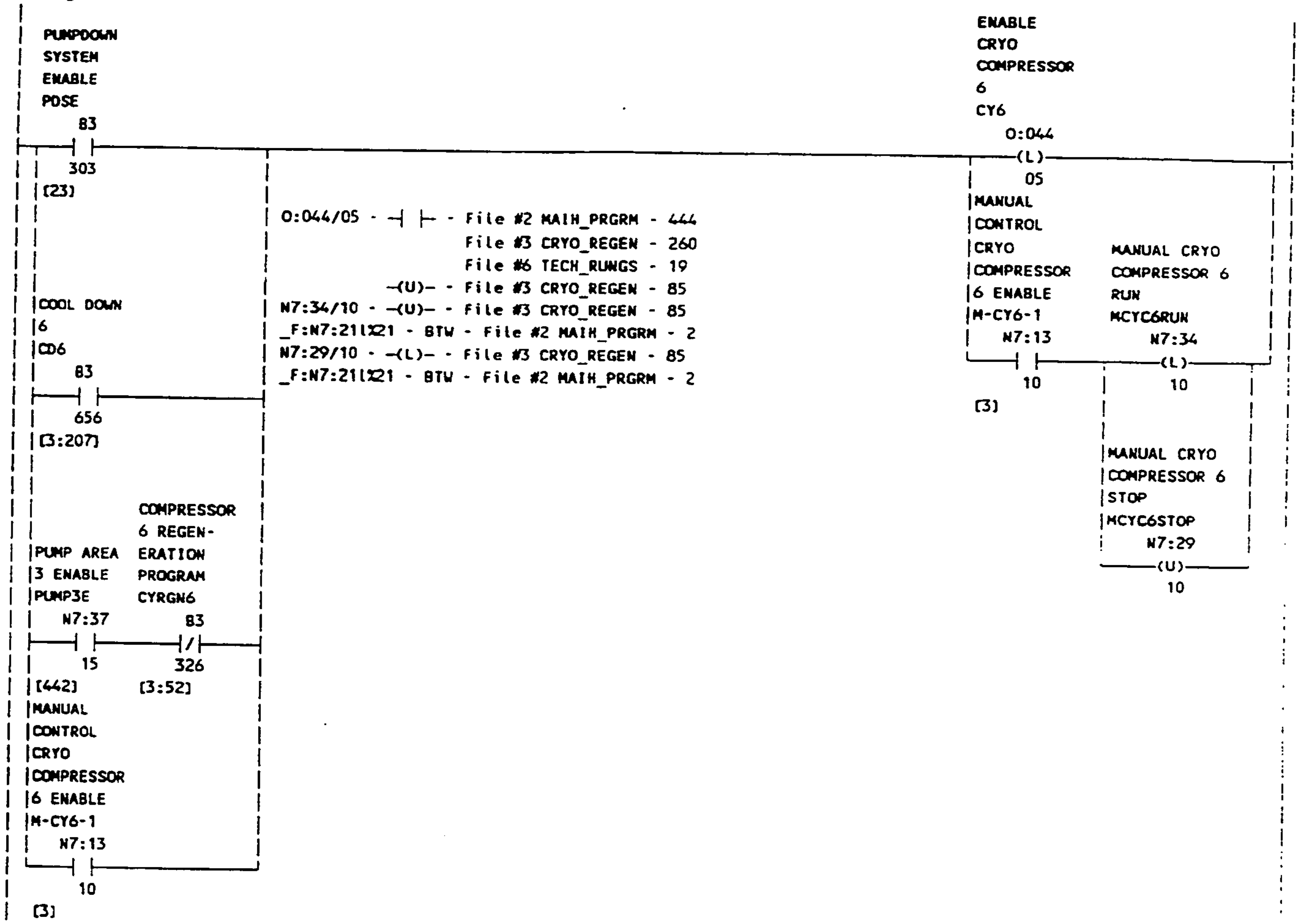
```
|                                                                                                  ENABLE
| PUMPDOWN                                                                                         CRYO
| SYSTEM                                                                                           COMPRESSOR
| ENABLE                                                                                           3
| PDSE                                                                                             CY3
|     B3                                                                                              O:030
|-+---] [---+--------------------------------------------------------------------------------+-------(L)-------+-|
| |   303   |                                                                                |      04         | |
| |[23]     |                                                                                |MANUAL           | |
| |         | O:030/04 - -] [- - File #2 MAIN_PRGRM - 440                                     |CONTROL          | |
| |         |                    File #3 CRYO_REGEN - 260                                     |CRYO        MANUAL CRYO  | |
| |         |                    File #6 TECH_RUNGS - 19                                      |COMPRESSOR  COMPRESSOR 3 | |
| |         |                 -(U)- - File #3 CRYO_REGEN - 82                                 |3 ENABLE    RUN      | |
| |COOL DOWN| N7:34/7 - -(U)- - File #3 CRYO_REGEN - 82                                       |M-CY3-1     MCYC3RUN | |
| |3        | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                     |   N7:13       N7:34  | |
| |CD3      | N7:29/7 - -(L)- - File #3 CRYO_REGEN - 82                                       +---] [---+----(L)-----+ |
| |    B3   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                          7    |     7      |   |
| +---] [---+                                                                                 [3]       |            |   |
| |   653   |                                                                                           |            |   |
| |[3:204]  |                                                                                           |MANUAL CRYO |   |
| |         |                                                                                           |COMPRESSOR 3|   |
| |         |                                                                                           |STOP        |   |
| |       COMPRESSOR                                                                                  |MCYC3STOP   |   |
| |       3 REGEN-                                                                                    |    N7:29   |   |
| |PUMP AREA  ERATION                                                                                 +----(U)-----+   |
| |2 ENABLE   PROGRAM                                                                                      7           |
| |PUMP2E     CYRGN3                                                                                                   |
| |  N7:37      B3  |                                                                                                  |
| +---] [------]/[--+                                                                                                  |
| |    14      323  |
| |[438]     [3:38] |
| |MANUAL           |
| |CONTROL          |
| |CRYO             |
| |COMPRESSOR       |
| |3 ENABLE         |
| |M-CY3-1          |
| |  N7:13          |
| +---] [-----------+
|      7
|  [3]
```

Rung #029

```
|                                                                                 ENABLE              |
| PUMPDOWN                                                                        CRYO                |
| SYSTEM                                                                          COMPRESSOR          |
| ENABLE                                                                          4                   |
| PDSE                                                                            CY4                 |
|     B3                                                                            O:030             |
|-+---] [--------+-----------------------------------------------------------+------(L)-------------+-|
| |  303         |                                                           |       05             | |
| | [23]         |                                                           |MANUAL                | |
| |              | O:030/05 - -] [- - File #2 MAIN_PRGRM - 440                 |CONTROL               | |
| |              |                    File #3 CRYO_REGEN - 260                 |CRYO      MANUAL CRYO | |
| |              |                    File #6 TECH_RUNGS - 19                  |COMPRESSOR COMPRESSOR 4 |
| |              |               -(U)- - File #3 CRYO_REGEN - 83               |4 ENABLE  RUN         | |
| |COOL DOWN     | N7:34/8 - -(U)- - File #3 CRYO_REGEN - 83                   |M-CY4-1   MCYC4RUN    | |
| |4             | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                 |  N7:13      N7:34    | |
| |CD4           | N7:29/8 - -(L)- - File #3 CRYO_REGEN - 83                   +---] [---+----(L)----+-+ |
| |   B3         | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     8     |     8     |   |
| |---] [--------|                                                          [3]        |           |   |
| |   654        |                                                                     |           |   |
| |[3:205]       |                                                                     |MANUAL CRYO|   |
| |              |                                                                     |COMPRESSOR 4   |
| |              |                                                                     |STOP       |   |
| |       COMPRESSOR                                                                   |MCYC4STOP  |   |
| |       4 REGEN-                                                                     |   N7:29   |   |
| |PUMP AREA ERATION                                                                   +----(U)----+   |
| |2 ENABLE PROGRAM                                                                         8          |
| |PUMP2E   CYRGN4                                                                                     |
| |  N7:37     B3                                                                                      |
| |---] [------]/[---|                                                                                 |
| |   14       324                                                                                     |
| |[438]    [3:42]                                                                                     |
| |MANUAL        |
| |CONTROL       |
| |CRYO          |
| |COMPRESSOR    |
| |4 ENABLE      |
| |M-CY4-1       |
| |  N7:13       |
| +---] [--------+
|     8
|  [3]
```

```
Rung #030
                                                                            ENABLE
| PUMPDOWN                                                                  CRYO
| SYSTEM                                                                    COMPRESSOR
| ENABLE                                                                    5
| PDSE                                                                      CY5
|     B3                                                                      O:044
|----| |---------------------------------------------------------------------(L)-----|
| |   303                      |                                             04
| |[23]                        |                                        |MANUAL
| |                            | O:044/04 - -| |- - File #2 MAIN_PRGRM - 440, 444  |CONTROL
| |                            |                    File #3 CRYO_REGEN - 260       |CRYO        MANUAL CRYO
| |                            |                    File #6 TECH_RUNGS - 19        |COMPRESSOR  COMPRESSOR 5
| |                            |              -(U)- - File #3 CRYO_REGEN - 84      |5 ENABLE    RUN
| |COOL DOWN                   | N7:34/9 - -(U)- - File #3 CRYO_REGEN - 84         |M-CY5-1     MCYC5RUN
| |5                           | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2       |  N7:13       N7:34
| |CD5                         | N7:29/9 - -(L)- - File #3 CRYO_REGEN - 84         |---| |----+----(L)----
| |   B3                       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2           9      |     9
| |--| |-----------------------|                                           [3]             |
|    655                       |                                                          |MANUAL CRYO
| |[3:206]                     |                                                          |COMPRESSOR 5
| |                            |                                                          |STOP
| |                 COMPRESSOR |                                                          |MCYC5STOP
| |                 5 REGEN-   |                                                          |   N7:29
| |   PUMP AREA     ERATION    |                                                          +----(U)----
| |   2 ENABLE      PROGRAM    |                                                               9
| |   PUMP2E        CYRGN5     |
| |     N7:37         B3       |
| |-+---| |----+------|/|-----|
| | |    14    |     325       |
| | |[438]     |   [3:46]      |
| | |PUMP AREA |               |
| | |3 ENABLE  |               |
| | |PUMP3E    |               |
| | |   N7:37  |               |
| | +---| |----+               |
| |      15                    |
| |  [442]                     |
| |MANUAL                      |
| |CONTROL                     |
| |CRYO                        |
| |COMPRESSOR                  |
| |5 ENABLE                    |
| |M-CY5-1                     |
| |   N7:13                    |
| +---| |----------------------+
|      9
|   [3]
```

Rung #031


PUMPDOWN SYSTEM ENABLE PDSE
B3
303
[23]
COOL DOWN 6 CD6
B3
656
[3:207]
PUMP AREA 3 ENABLE PUMP3E
N7:37
15
[442]
COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6
B3
326
[3:52]
MANUAL CONTROL CRYO COMPRESSOR 6 ENABLE M-CY6-1
N7:13
10
[3]
O:044/05 - ┤ ├ - - File #2 MAIN_PRGRM - 444
File #3 CRYO_REGEN - 260
File #6 TECH_RUNGS - 19
-(U)- - File #3 CRYO_REGEN - 85
N7:34/10 - -(U)- - File #3 CRYO_REGEN - 85
_F:N7:21[21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/10 - -(L)- - File #3 CRYO_REGEN - 85
_F:N7:21[21 - BTW - File #2 MAIN_PRGRM - 2
ENABLE CRYO COMPRESSOR 6 CY6
O:044
-(L)-
05
MANUAL CONTROL CRYO COMPRESSOR 6 ENABLE M-CY6-1
N7:13
10
[3]
MANUAL CRYO COMPRESSOR 6 RUN MCYC6RUN
N7:34
-(L)-
10
MANUAL CRYO COMPRESSOR 6 STOP MCYC6STOP
N7:29
-(U)-
10

```
Rung #032
                                                                        ENABLE
 PUMPDOWN                                                               CRYO
 SYSTEM                                                                 COMPRESSOR
 ENABLE                                                                 7
 PDSE                                                                   CY7
    B3                                                                    O:060
|---] [-----------------------------------------------------------------+----(L)-----+
| | 303                           |                                      |    04      |
| |[23]                           |                                      |MANUAL      |
| |                               | O:060/04 - -] [- - File #2 MAIN_PRGRM - 449, 453 |CONTROL
| |                               |                File #3 CRYO_REGEN - 260          |CRYO       MANUAL CRYO
| |                               |                File #6 TECH_RUNGS - 19           |COMPRESSOR COMPRESSOR 7
| |                               |          -(U)- - File #3 CRYO_REGEN - 86         |7 ENABLE   RUN
| |COOL DOWN                      | N7:34/11 - -(U)- - File #3 CRYO_REGEN - 86       |M-CY7-1    MCYC7RUN
| |7                              | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2      |  N7:13      N7:34
| |CD7                            | N7:29/11 - -(L)- - File #3 CRYO_REGEN - 86       +---] [---+----(L)----+
| |  B3                           | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2      |   11    |    11     |
| +---] [-------------------------+                                                  |[3]      |           |
| |  657                          |                                                            |MANUAL CRYO|
| |[3:208]                        |                                                            |COMPRESSOR 7
| |                               |                                                            |STOP       |
| |              COMPRESSOR       |                                                            |MCYC7STOP  |
| |              7 REGEN-         |                                                            |    N7:29  |
| |  PUMP AREA   ERATION          |                                                            +----(U)----+
| |  4 ENABLE    PROGRAM          |                                                                  11
| |  PUMP4E      CYRGN7           |
| |    N7:38       B3             |
| +-+---] [---+----]/[------------+
| | |    0    |   327             |
| | |[447]    | [3:57]            |
| | |PUMP AREA|                   |
| | |5 ENABLE |                   |
| | |PUMP5E   |                   |
| | |  N7:38  |                   |
| | +---] [---+                   |
| |      1                        |
| |  [451]                        |
| |MANUAL                         |
| |CONTROL                        |
| |CRYO                           |
| |COMPRESSOR                     |
| |7 ENABLE                       |
| |M-CY7-1                        |
| |  N7:13                        |
| +---] [-------------------------+
|     11
| [3]
```

Rung #033

```
PUMPDOWN                                                                    ENABLE
SYSTEM                                                                      CRYO
ENABLE                                                                      COMPRESSOR
PDSE                                                                        8
                                                                            CY8
  B3                                                                          O:060
--] [--------------------------------------------------------------------------(L)--
  303                                                                          05
[23]                                                                        MANUAL
          O:060/05 - -] [- - File #2 MAIN_PRGRM - 449                       CONTROL
                             File #3 CRYO_REGEN - 260                       CRYO          MANUAL CRYO
                             File #6 TECH_RUNGS - 19                        COMPRESSOR    COMPRESSOR 8
                      -(U)- - File #3 CRYO_REGEN - 87                       8 ENABLE      RUN
COOL DOWN  N7:34/12 - -(U)- - File #3 CRYO_REGEN - 87                       M-CY8-1       MCYC8RUN
8          _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                        N7:13         N7:34
CD8        N7:29/12 - -(L)- - File #3 CRYO_REGEN - 87                       --] [----------(L)--
  B3       _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                        12            12
--] [--                                                                     [3]
  658                                                                                   MANUAL CRYO
[3:209]                                                                                 COMPRESSOR 8
                                                                                        STOP
              COMPRESSOR                                                                MCYC8STOP
              8 REGEN-                                                                    N7:29
PUMP AREA     ERATION                                                                   ----(U)--
4 ENABLE      PROGRAM                                                                     12
PUMP4E        CYRGN8
  N7:38         B3
--] [-----------]/[--
  0             328
[447]         [3:63]
MANUAL
CONTROL
CRYO
COMPRESSOR
8 ENABLE
M-CY8-1
  N7:13
--] [--
  12
[3]
```

Rung #034

```
| MANUAL                                                                  OPEN RGA   |
| CONTROL                                                                 ISOLATION  |
| RGA VALVE                                                               VALVE 1    |
| 1 CLOSE                                                                 RGAV1      |
| M-RGAV1-0                                                                 O:010    |
|   N7:9                                                                             |
|---] [---+-------------------------------------------------------------+----(U)---+-|
|    1    |                                                             |     13     | |
| [3]     |                                                             |            | |
|         | O:010/13 - ] [ - File #6 TECH_RUNGS - 7                     |            | |
|         |            -(L)- - File #2 MAIN_PRGRM - 371                 |MANUAL RGA  | |
|         | N7:28/5 - -(L)- - File #2 MAIN_PRGRM - 371                  |VALVE 1     | |
|         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |OPEN        | |
|VENT AREA| N7:30/1 - -(U)- - File #2 MAIN_PRGRM - 371                  |MRGAV1OP    | |
|1 ENABLE | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |   N7:28    | |
|VENT1E   |                                                             +----(U)-----+ |
|  N7:37  |                                                             |     5      | |
+---] [---+                                                             |            | |
|    6    |                                                             |MANUAL RGA  | |
|[405]    |                                                             |VALVE 1     | |
|         |                                                             |CLOSE       | |
|         |                                                             |MRGAV1CL    | |
|SYSTEM   |                                                             |   N7:30    | |
|VENT     |                                                             +----(L)-----+ |
|ENABLE   |                                                                   1        |
|SYSVNTE  |                                                                            |
| N7:37   |                                                                            |
+---] [---+                                                                            |
|    5    |                                                                            |
|[368]    |                                                                            |
|HEATER 1 |                                                                            |
|CHAMBER  |                                                                            |
|=<250    |                                                                            |
|MICRONS  |                                                                            |
|PIR2     |                                                                            |
|  I:004  |                                                                            |
+---]/[---+                                                                            |
    10
```

```
Rung #035
| MANUAL                                                                    OPEN RGA
| CONTROL                                                                   ISOLATION
| RGA VALVE                                                                 VALVE 2
| 2 CLOSE                                                                   RGAV2
| M-RGAV2-0                                                                   O:030
|    N7:9
|---+---] [---+-------------------------------------------------------------+---(U)---+
|   |    2    |                                                             |   13    |
|   |[3]      |                                                             |         |
|   |         | O:030/13 - ] [ - File #6 TECH_RUNGS - 7                     |         |
|   |         |           -(L)- - File #2 MAIN_PRGRM - 372                  |MANUAL RGA
|   |         | N7:28/6 - -(L)- - File #2 MAIN_PRGRM - 372                  |VALVE 2  |
|   |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |OPEN     |
|   |VENT AREA| N7:30/2 - -(U)- - File #2 MAIN_PRGRM - 372                  |MRGAV2OP |
|   |2 ENABLE | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |  N7:28  |
|   |VENT2E   |                                                             +---(U)---+
|   |  N7:37  |                                                             |    6    |
|   +---] [---+                                                             |         |
|   |    7    |                                                             |         |
|   |[411]    |                                                             |MANUAL RGA
|   |         |                                                             |VALVE 2 CLOSE
|   |         |                                                             |MRGAV2CL |
|   |SYSTEM   |                                                             |  N7:30  |
|   |VENT     |                                                             +---(L)---+
|   |ENABLE   |                                                                  2
|   |SYSVNTE  |
|   |  N7:37  |
|   +---] [---+
|   |    5    |
|   |[368]    |
|   |CHROME   |
|   |CHAMBER  |
|   |=<250    |
|   |MICRONS  |
|   |PIR6     |
|   |  I:024  |
|   +---]/[---+
|       07
```

Rung #036

```
| SYSTEM                                                                  OPEN RGA        |
| VENT                                                                    ISOLATION       |
| ENABLE                                                                  VALVE 3         |
| SYSVNTE                                                                 RGAV3           |
|   N7:37                                                                   O:044         |
|---+--] [--+-------------------------------------------------------------+---(U)-------+-|
|   |   5    |                                                          |    13        |
|   | [368]  |                                                          |              |
|   |        | O:044/13 - ] [ - File #6 TECH_RUNGS - 7                  |              |
|   |        |           -(L)- - File #2 MAIN_PRGRM - 373               |MANUAL RGA    |
|   |        | N7:28/7 - -(L)- - File #2 MAIN_PRGRM - 373               |VALVE 3       |
|   |        | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2               |OPEN          |
|   |VENT AREA | N7:30/3 - -(U)- - File #2 MAIN_PRGRM - 373             |MRGAV3OP      |
|   |3 ENABLE  | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2            |  N7:28       |
|   |VENT3E  |                                                          +---(U)--------+
|   |  N7:37 |                                                          |    7         |
|   +--] [---+                                                          |              |
|   |   8    |                                                          |              |
|   | [418]  |                                                          |              |
|   |        |                                                          |MANUAL RGA    |
|   |        |                                                          |VALVE 3 CLOSE |
|   |MANUAL  |                                                          |MRGAV3CL      |
|   |CONTROL |                                                          |   N7:30      |
|   |RGA VALVE |                                                        +---(L)--------+
|   |3 CLOSE |                                                               3          |
|   |M-RGAV3-0 |                                                                        |
|   |  N7:9  |                                                                          |
|   +--] [---+                                                                          |
|   |   3    |                                                                          |
|   | [3]    |                                                                          |
|   |MAGNETIC |                                                                         |
|   |CHAMBER |                                                                          |
|   |=<250   |                                                                          |
|   |MICRONS |                                                                          |
|   |PIR11   |                                                                          |
|   |  I:040 |                                                                          |
|   +--]/[---+                                                                          |
|      07                                                                               |
```

```
Rung #037
| MANUAL                                                                                  OPEN RGA
| CONTROL                                                                                 ISOLATION
| RGA VALVE                                                                               VALVE 4
| 4 CLOSE                                                                                 RGAV4
| M-RGAV4-0                                                                                 O:060
|   N7:9                                                                                  --(U)--
|--| |--------------------------------------------------------------------------------------
|     4                                                                                     13
| [3]
|           | O:060/13 - -| |- - File #6 TECH_RUNGS - 7
|           |          -(L)- - File #2 MAIN_PRGRM - 374                                  |MANUAL RGA
|           | N7:28/8 - -(L)- - File #2 MAIN_PRGRM - 374                                 |VALVE 4
| SYSTEM    | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |OPEN
| VENT      | N7:30/4 - -(U)- - File #2 MAIN_PRGRM - 374                                 |MRGAV4OP
| ENABLE    | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |  N7:28
| SYSVNTE                                                                                |---(U)---
|   N7:37                                                                                    8
|--| |--|
|    5
| [368]
                                                                                         |MANUAL RGA
                                                                                         |VALVE 4 CLOSE
                                                                                         |MRGAV4CL
                                                                                            N7:30
| VENT AREA                                                                              ----(L)----
| 4 ENABLE                                                                                   4
| VENT4E
|   N7:37
|--| |--|
|    9
| [425]
| CARBON
| CHAMBER
| =<250
| MICRONS
| PIR16
|   I:054
|--|/|--|
|    07
```

```
Rung #038
| MANUAL                                                                    |
| CONTROL                                                       OPEN        |
| GAS FLOW                                                      GAS FLOW    |
| VALVE 1                                                       ISOLATION   |
| CLOSE                                                         VALVE 1     |
| M-GF1-0                                                       GF1         |
|    N7:9                                                          O:010    |
|-+--| |--+----------------------------------------------------+----(U)----+-|
| |   7    |                                                   |     07     | |
| |[3]     |                                                   |            | |
| |        | O:010/07 - -(L)- - File #2 MAIN_PRGRM - 379       |            | |
| |        | N7:30/15 - -(L)- - File #2 MAIN_PRGRM - 379       |MANUAL GAS  | |
| |        | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       |FLOW I V 1  | |
| |        | N7:30/7 - -(U)- - File #2 MAIN_PRGRM - 379        |OPEN        | |
| |AUTO OFF| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       |MGFIV1OP    | |
| |PULSE   |                                                   |   N7:30    | |
| |AUOFPULSE                                                   +----(U)----+ |
| | T4:283 |                                                   |    15      | |
| +--| |---+                                                   |            | |
| |   TT   |                                                   |            | |
| |[155]   |                                                   |MANUAL GAS  | |
| |        |                                                   |FLOW I V 1  | |
| |        |                                                   |CLOSE       | |
| |        |                                                   |MGFIV1CL    | |
| |        |                                                   |   N7:30    | |
| |HEATER 1|                                                   +----(L)----+ |
| |HIVAC BAFFLE                                                     7        |
| |HV1_2   |                                                                 |
| |  O:011 |                                                                 |
| +---|/|--+                                                                 |
|      12                                                                    |
| [116]                                                                      |
Rung #039
| MANUAL                                                                    |
| CONTROL                                                       OPEN        |
| GAS FLOW                                                      GAS FLOW    |
| VALVE 2                                                       ISOLATION   |
| CLOSE                                                         VALVE 2     |
| M-GF2-0                                                       GF2         |
|    N7:9                                                          O:010    |
|-+--| |--+----------------------------------------------------+----(U)----+-|
| |   8    |                                                   |     10     | |
| |[3]     |                                                   |            | |
| |        | O:010/10 - -(L)- - File #2 MAIN_PRGRM - 380       |            | |
| |        | N7:31/0 - -(L)- - File #2 MAIN_PRGRM - 380        |MANUAL GAS  | |
| |        | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       |FLOW I V 2  | |
| |        | N7:30/8 - -(U)- - File #2 MAIN_PRGRM - 380        |OPEN        | |
| |AUTO OFF| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       |MGFIV2OP    | |
| |PULSE   |                                                   |   N7:31    | |
| |AUOFPULSE                                                   +----(U)----+ |
| | T4:283 |                                                   |     0      | |
| +--| |---+                                                   |            | |
|     TT                                                       |            | |
| [155]                                                        |MANUAL GAS  | |
|                                                              |FLOW I V 2  | |
|                                                              |CLOSE       | |
|                                                              |MGFIV2CL    | |
|                                                              |   N7:30    | |
|                                                              +----(L)----+ |
|                                                                   8        |
```

```
BASE :   Rung #040
| MANUAL                                                             OPEN
| CONTROL                                                            GAS FLOW
| GAS FLOW                                                           ISOLATION
| VALVE 3                                                            VALVE 3
| CLOSE                                                              GF3
| M-GF3-0                                                             O:030
|   N7:9                                                         
|---] [----+-------------------------------------------------------+---(U)---
| |   9    |                                                       |    07
| |[3]     |                                                       |
| |        | O:030/07 - ] [ - - File #2 MAIN_PRGRM - 156           |
| |        |          -(L)- - File #2 MAIN_PRGRM - 381             |MANUAL GAS
| |        | N7:31/1 - -(L)- - File #2 MAIN_PRGRM - 381            |FLOW I V 3
| |        | _F:N7:21 X21 - BTW - File #2 MAIN_PRGRM - 2           |OPEN
| |AUTO OFF| N7:30/9 - -(U)- - File #2 MAIN_PRGRM - 381            |MGFIV3OP
| |PULSE   | _F:N7:21 X21 - BTW - File #2 MAIN_PRGRM - 2           |  N7:31
| |AUOFPULSE                                                       +---(U)---
| | T4:283 |                                                       |    1
| +---] [--+                                                       |
|     TT                                                           |
| [155]                                                            |MANUAL GAS
|                                                                  |FLOW I V 3
|                                                                  |CLOSE
|                                                                  |MGFIV3CL
|                                                                  |  N7:30
|                                                                  +---(L)---
|                                                                       9
```

Rung #041

```
| MANUAL                                                                          OPEN
| CONTROL                                                                         GAS FLOW
| GAS FLOW                                                                        ISOLATION
| VALVE 4                                                                         VALVE 4
| CLOSE                                                                           GF4
| M-GH4-0                                                                           O:030
|    N7:9
|----] [-----------------------------------------------------------------------+----(U)----+
| |   10   |                                                                   |    10     |
| |[3]     |                                                                   |           |
| |        | O:030/10 - -(L)- - File #2 MAIN_PRGRM - 382                       |           |
| |        | N7:31/2 - -(L)- - File #2 MAIN_PRGRM - 382                        |MANUAL GAS |
| |        | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |FLOW I V 4 |
| |        | N7:30/10 - -(U)- - File #2 MAIN_PRGRM - 382                       |OPEN       |
| |AUTO OFF| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |MGFIV4OP   |
| |PULSE   |                                                                   |   N7:31   |
| |AUOFPULSE                                                                   +----(U)----+
| |  T4:283|                                                                   |     2     |
| +---] [--+                                                                   |           |
|      TT                                                                      |MANUAL GAS |
|  [155]                                                                       |FLOW I V 4 |
|                                                                              |CLOSE      |
|                                                                              |MGFIV4CL   |
|                                                                              |   N7:30   |
|                                                                              +----(L)----
|                                                                                   10
```

```
BASE :   Rung #042
| MANUAL
| CONTROL                                                                          GAS FLOW
| GAS FLOW                                                                         ISOLATION
| VALVE 5                                                                          VALVE 5
| CLOSE                                                                            GFS
| M-GF5-0                                                                            O:044
|   N7:9
|---] [----------------------------------------------------------------------------+--(U)--+
|  11                                                                              |  07   |
| [3]                                                                              |       |
|          | O:044/07 - ] [ - File #2 MAIN_PRGRM - 156                             |       |
|          |           -(L)- - File #2 MAIN_PRGRM - 383                            |MANUAL GAS
|          | N7:31/3 - -(L)- - File #2 MAIN_PRGRM - 383                            |FLOW I V 5
|          | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                           |OPEN
|AUTO OFF  | N7:30/11 - -(U)- - File #2 MAIN_PRGRM - 383                           |MGFIV5OP
|PULSE     | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                           |  N7:31
|AUOFPULSE |                                                                       +--(U)--+
|  T4:283  |                                                                       |   3   |
|---] [----+                                                                       |       |
|   TT                                                                             |MANUAL GAS
| [155]                                                                            |FLOW I V 5
|                                                                                  |CLOSE
|                                                                                  |MGFIV5CL
|                                                                                  |  N7:30
|                                                                                  +--(L)--+
|                                                                                     11
```

```
Rung #043
| MANUAL                                                                                GAS FLOW        |
| CONTROL                                                                               ISOLATION       |
| GAS FLOW                                                                              VALVE 6         |
| VALVE 6                                                                               GF6             |
| CLOSE                                                                                   O:044         |
| M-GF6-0                                                                             +----(U)-----+--+
|     N7:9                                                                            |     10     |  |
+-+---] [---+-------------------------------------------------------------------------+            |  |
| |   12    |                                                                         |            |  |
| |[3]      |                                                                         |MANUAL GAS  |  |
| |         | O:044/10 - -(L)- - File #2 MAIN_PRGRM - 384                             |FLOW I V 6  |  |
| |         | N7:31/4 - -(L)- - File #2 MAIN_PRGRM - 384                              |OPEN        |  |
| |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                             |MGFIV6OP    |  |
| |SYSTEM   | N7:30/12 - -(U)- - File #2 MAIN_PRGRM - 384                             |  N7:31     |  |
| |VENT     | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                             +----(U)-----+  |
| |ENABLE   |                                                                         |     4      |  |
| |SYSVNTE  |                                                                         |            |  |
| |  N7:37  |                                                                         |MANUAL GAS  |  |
| +---] [---+                                                                         |FLOW I V 6  |  |
| |    5    |                                                                         |CLOSE       |  |
| |[368]    |                                                                         |MGFIV6CL    |  |
| |         |                                                                         |  N7:30     |  |
| |         |                                                                         +----(L)-----+  |
| |VENT AREA|                                                                               12        |
| |3 ENABLE |                                                                                         |
| |VENT3E   |                                                                                         |
| |  N7:37  |                                                                                         |
| +---] [---+                                                                                         |
|      8                                                                                              |
|  [418]
```

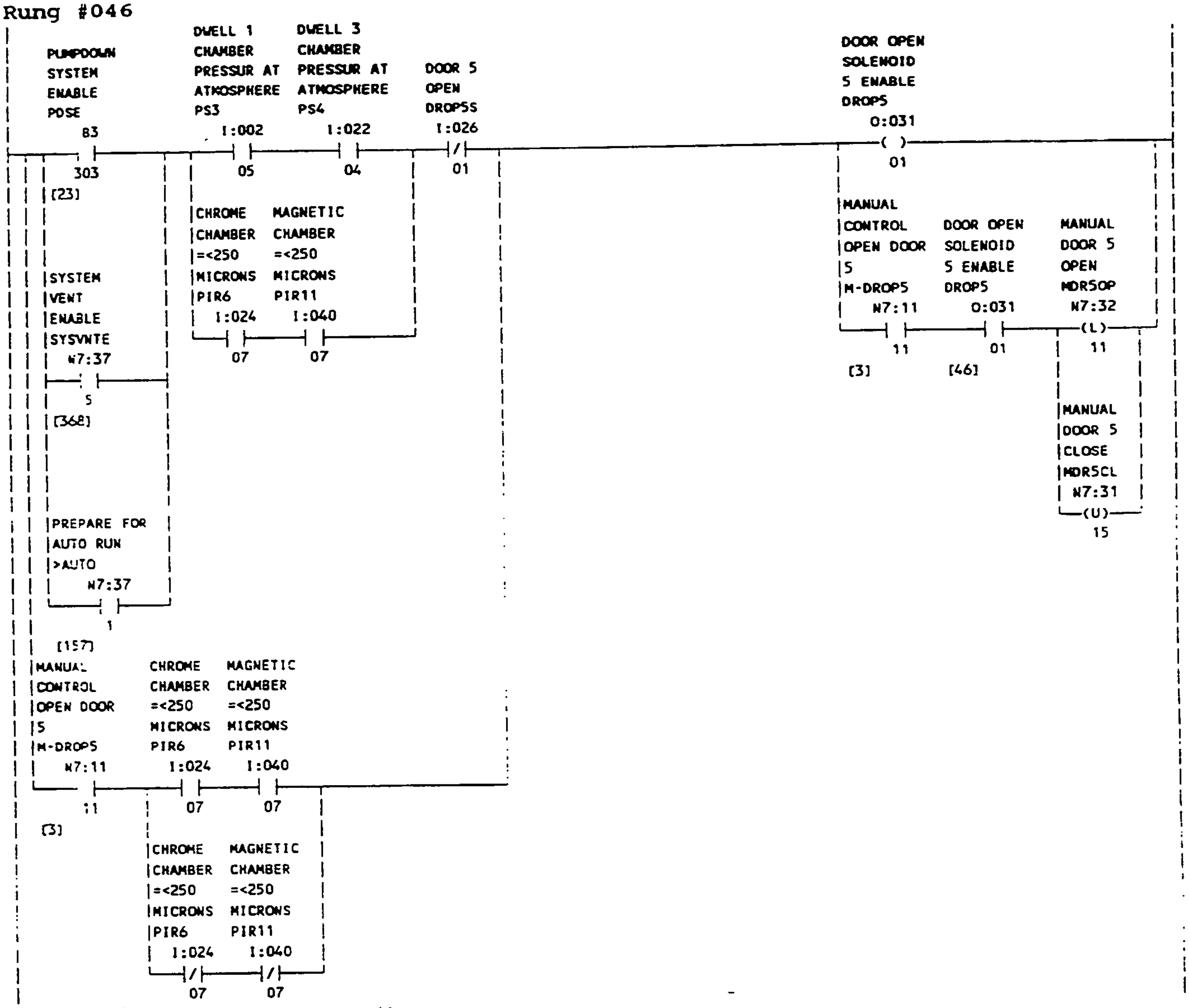
BASE : Rung #044

```
| MANUAL                                                                                  |
| CONTROL                                                                                 |
| GAS FLOW                                                                     GAS FLOW   |
| VALVE 7                                                                      ISOLATION  |
| CLOSE                                                                        VALVE 7    |
| M-GF7-0                                                                      GF7        |
|    N7:9                                                                        O:060    |
|-+---] [---+-----------------------------------------------------------------+----(U)----+-+
| |   13    |                                                                 |    07     | |
| |[3]      |                                                                 |           | |
| |         | O:060/07 - ] [ - File #2 MAIN_PRGRM - 156                       |           | |
| |         |           -(L)- - File #2 MAIN_PRGRM - 385                      |MANUAL GAS | |
| |         | N7:31/5 - -(L)- - File #2 MAIN_PRGRM - 385                      |FLOW I V 7 | |
| |         | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                     |OPEN       | |
| |AUTO OFF | N7:30/13 - -(U)- - File #2 MAIN_PRGRM - 385                     |MGFIV7OP   | |
| |PULSE    | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                     |  N7:31    | |
| |AUOFPULSE|                                                                 +----(U)----+ |
| | T4:283  |                                                                 |    5      | |
| +---] [---+                                                                 |           | |
|      TT                                                                     |           | |
|  [155]                                                                      |MANUAL GAS | |
|                                                                             |FLOW I V 7 | |
|                                                                             |CLOSE      | |
|                                                                             |MGFIV7CL   | |
|                                                                             |  N7:30    |
|                                                                             +----(L)----+
                                                                                   13
```

BASE : Rung #045

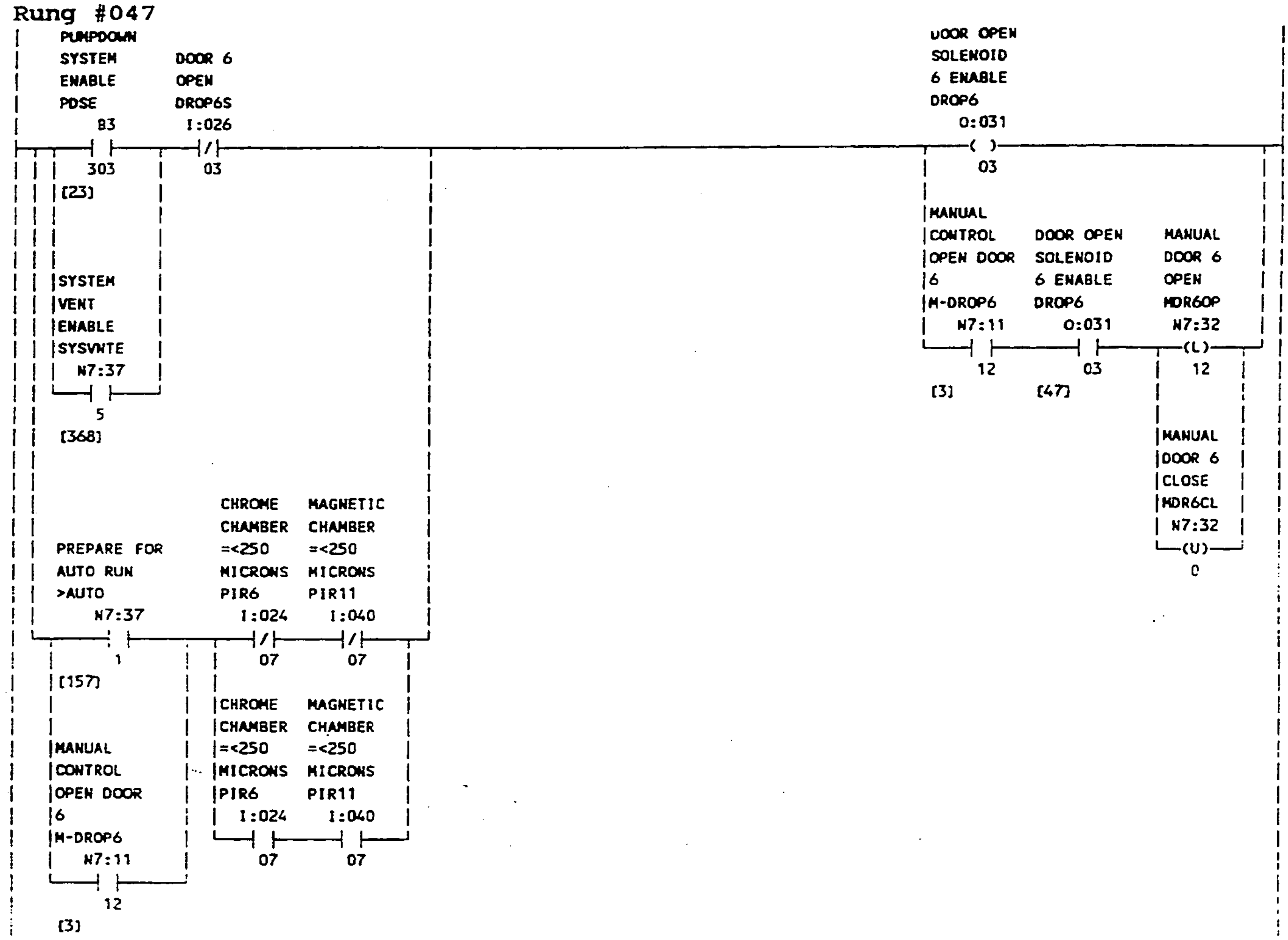
```
| MANUAL                                                        GAS FLOW
| CONTROL                                                       ISOLATION
| GAS FLOW                                                      VALVE 8
| VALVE 8                                                       GF8
| CLOSE                                                           O:060
| M-GF8-0                                                   +----(U)----+
|    N7:9                                                   |    10     |
+---] [---+-------------------------------------------------+           |
| |   14  |                                                 |MANUAL GAS |
| |[3]    | O:060/10 - -(L)- - File #2 MAIN_PRGRM - 386     |FLOW I V 8 |
| |       | N7:31/6 - -(L)- - File #2 MAIN_PRGRM - 386      |OPEN       |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2     |MGFIV8OP   |
| |       | N7:30/14 - -(U)- - File #2 MAIN_PRGRM - 386     |   N7:31   |
| |AUTO OFF | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2   +----(U)----+
| |PULSE    |                                               |    6      |
| |AUOFPULSE|                                               |MANUAL GAS |
| |  T4:283 |                                               |FLOW I V 8 |
| +---] [---+                                               |CLOSE      |
|      TT                                                   |MGFIV8CL   |
| [155]                                                     |   N7:30   |
|                                                           +----(L)----+
|                                                                14
```

Rung #046



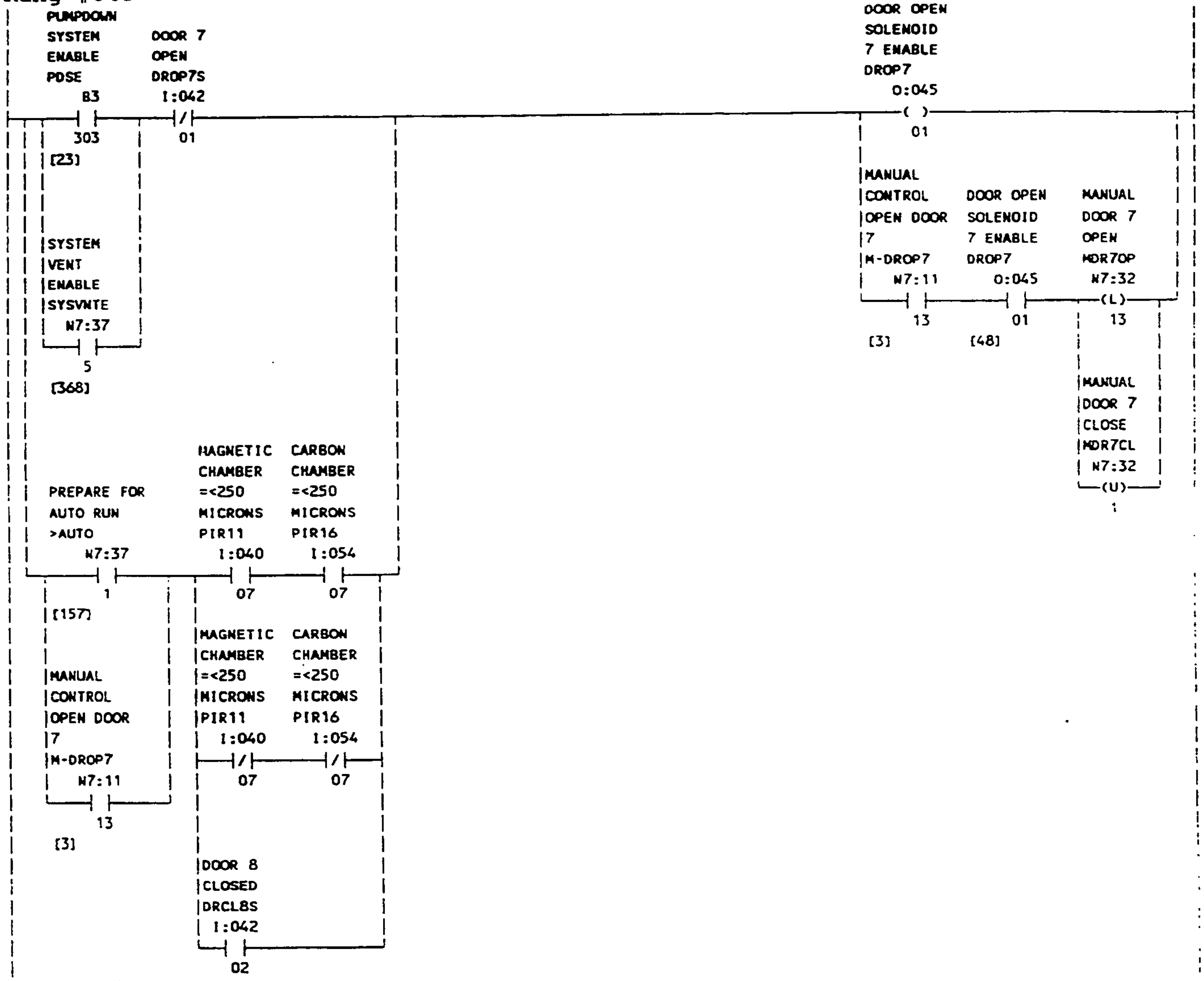
O:031/01 - ┤ ├ - - File #2 MAIN_PRGRM - 46
File #5 FAULTS - 49
File #6 TECH_RUNGS - 2
-( )- - File #2 MAIN_PRGRM - 46
N7:32/11 - -(L)- - File #2 MAIN_PRGRM - 46
-(U)- - File #2 MAIN_PRGRM - 414
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2
N7:31/15 - -(L)- - File #2 MAIN_PRGRM - 414
-(U)- - File #2 MAIN_PRGRM - 46
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2

Rung #047



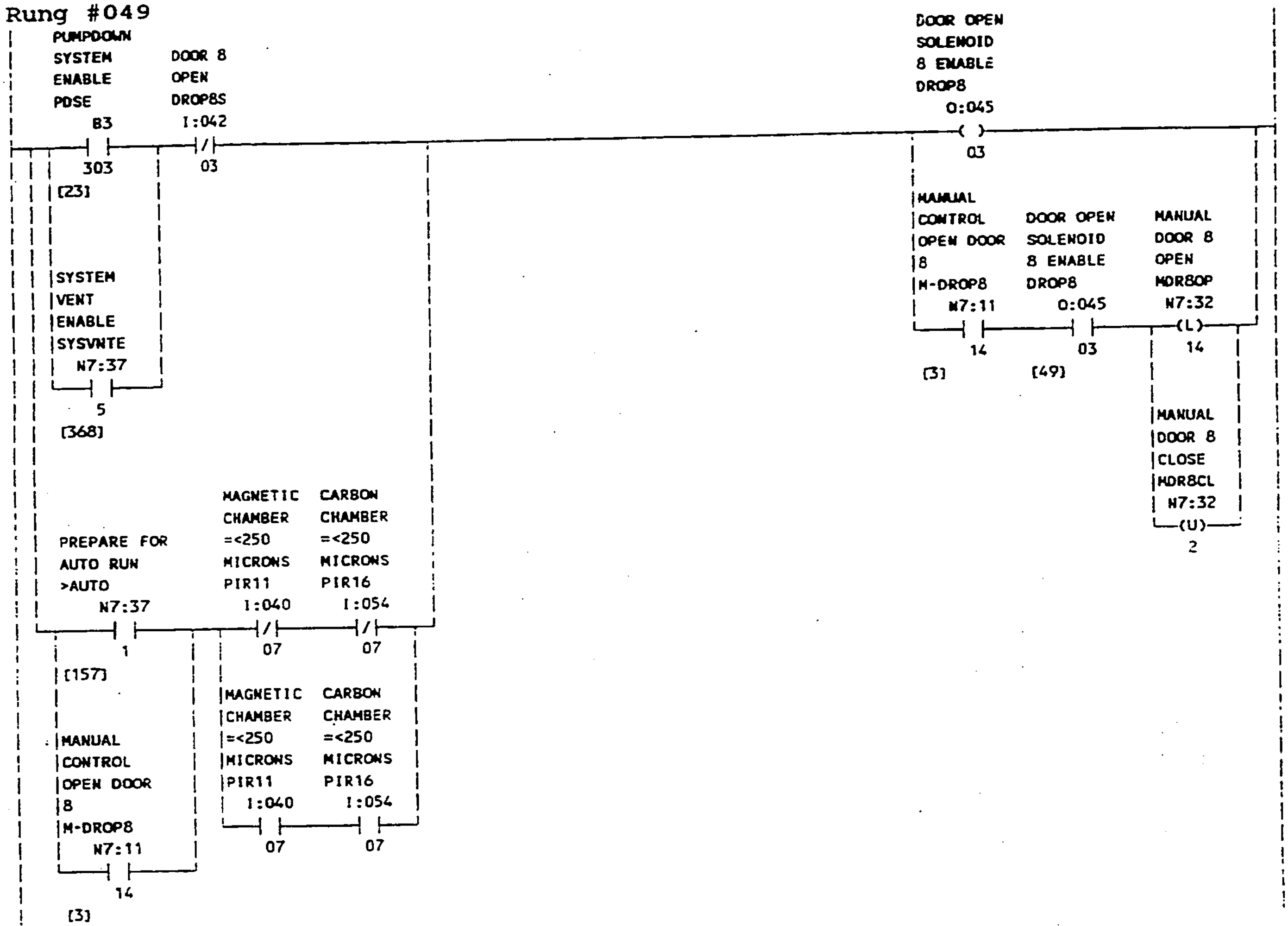

```
O:031/03 - -| |- - File #2 MAIN_PRGRM -  47
                   File #5 FAULTS -  51
                   File #6 TECH_RUNGS -  2
          -( )- - File #2 MAIN_PRGRM -  47
N7:32/12 - -(L)- - File #2 MAIN_PRGRM -  47
          -(U)- - File #2 MAIN_PRGRM -  420
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/0 - -(L)- - File #2 MAIN_PRGRM -  420
          -(U)- - File #2 MAIN_PRGRM -  47
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #048



O:045/01 - ┤ ├ - File #2 MAIN_PRGRM - 48
File #5 FAULTS - 53
File #6 TECH_RUNGS - 3
-( )- - File #2 MAIN_PRGRM - 48
N7:32/13 - -(L)- - File #2 MAIN_PRGRM - 48
-(U)- - File #2 MAIN_PRGRM - 422
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
N7:32/1 - -(L)- - File #2 MAIN_PRGRM - 422
-(U)- - File #2 MAIN_PRGRM - 48
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2

Rung #049




```
O:045/03 - -| |- - File #2 MAIN_PRGRM -  49
                  File #5 FAULTS -  55
                  File #6 TECH_RUNGS -  3
          -( )- - File #2 MAIN_PRGRM -  49
N7:32/14 - -(L)- - File #2 MAIN_PRGRM -  49
          -(U)- - File #2 MAIN_PRGRM -  427
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/2 - -(L)- - File #2 MAIN_PRGRM -  427
          -(U)- - File #2 MAIN_PRGRM -  49
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #050

```
|DWELL 1                                                                                  |
|CHAMBER                                                                                  |
|PRESSUR AT                                                     CHAMBER VENT 2            |
|ATMOSPHERE                                                     CLOSE DELAY               |
|PS3                                                            CV2_DLY                   |
|   I:002                                                       +-TON--------------+      |
|----] [--------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|     05                                                        |TIMER:     T4:318 |      |
|                                                               |BASE (SEC):   1.0 +-(DN) |
| T4:318.DN - ] [ - File #2 MAIN_PRGRM - 51                     |PRESET:         2 |      |
|                                                               |ACCUM:          0 |      |
|                                                               +------------------+      |
```

Rung #051

```
| CV2_DLY                                                                 OPEN
|  T4:318                                                                 DWELL 2
|----| |---------+                                                        VENT VALVE
|  |    DN       |                                                        CV2
|  |[50]         |                                                          0:007
|  |             |  0:007/17 - -| |- - File #5 FAULTS - 144          ------(U)------|
|  |MANUAL       |                     File #6 TECH_RUNGS - 0                 17
|  |CONTROL      |            -|/|- - File #2 MAIN_PRGRM - 368
|  |CHAMBER      |                     File #5 FAULTS - 146
|  |VENT VALVE   |            -(L)- - File #2 MAIN_PRGRM - 396
|  |CLOSE        |
|  |M-CV2-0      |
|  |   N7:4      |
|  |----| |------|
|  |     1       |
|  |[3]          |
|  |HEATER 2     |
|  |CHAMBER      |
|  |GATE VALVE   DOOR 4 |
|  |CLOSE        CLOSED |
|  |HV2S1        DRCL4S |
|  |  I:004      I:006  |
|  |----|/|--------|/|--|
|  |    00          06  |
|  |DWELL 1      |
|  |CHAMBER      |
|  |GATE VALVE   |
|  |CLOSED       |
|  |HV3S1        |
|  |  I:004      |
|  |----|/|------|
|  |    03       |
|  |DWELL 2      |
|  |CHAMBER      |
|  |GATE VALVE   |
|  |CLOSED       |
|  |HV4S1        |
|  |  I:022      |
|  |----|/|------|
|  |    06       |
|  |HEATER 3     |
|  |CHAMBER      |
|  |GATE VALVE   |
|  |CLOSED       |
|  |HV5S1        |
|  |  I:024      |
|  |----|/|------|
|  |    00       |
|  |ABORT SYSTEM |
|  |VENT         |
|  |BORT_SYS_VNT |
|  |   N7:17     |
|  +----| |------+
|        10
|  [3]
```

Rung #052

```
|DWELL 3                                                                                  |
|CHAMBER                                                                 CHAMBER VENT 3   |
|PRESSUR AT                                                              CLOSE DELAY      |
|ATMOSPHERE                                                              CV3_DLY          |
|PS4                                                                     +--TON----------+|
|   I:022                                                                                 |
|----] [-------------------------------------------------------------+-|TIMER ON DELAY |-(EN)-|
|     04                                                               |TIMER:    T4:319|      |
|                                                                      |BASE (SEC):  1.0|-(DN) |
| T4:319.DN - ] [ - File #2 MAIN_PRGRM - 53                            |PRESET:        2|      |
|                                                                      |ACCUM:         0|      |
|                                                                      +----------------+      |
```

```
Rung #053
                                                                    OPEN
                                                                    DWELL 3
                                                                    VENT VALVE
   CV3_DLY                                                          CV3
   T4:319                                                             O:027
|----] [----+-----------------------------------------------------------(U)----|
|      DN   |                                                            16
|  [52]     |
|           |  O:027/16 - ] [ - File #5 FAULTS - 148
| MANUAL    |                   File #6 TECH_RUNGS - 0
| CONTROL   |             ]/[ - File #2 MAIN_PRGRM - 368
| CHAMBER   |                   File #5 FAULTS - 150
| VENT VALVE|             -(L)- - File #2 MAIN_PRGRM - 401
| CLOSE     |
| M-CV3-0   |
|     N7:4  |
|----] [----+
|      2    |
| [3]       |
|          HEATER 3
|          CHAMBER
| DOOR 6   GATE VALVE
| CLOSED   CLOSED
| DRCL6S   HV5S1
|  I:026    I:024
|----]/[-----]/[----+
|    02       00    |
| DWELL 3           |
| CHAMBER           |
| GATE VALVE        |
| CLOSED            |
| HV6S1             |
|    I:024          |
|----]/[------------+
|     03            |
| DWELL 4           |
| CHAMBER           |
| GATE VALVE        |
| CLOSED            |
| HV7S1             |
|    I:036          |
|----]/[------------+
|     06            |
| BUFFER 3          |
| CHAMBER           |
| GATE VALVE        |
| CLOSED            |
| HV8S1             |
|    I:040          |
|----]/[------------+
|     00            |
| ABORT SYSTEM      |
| VENT              |
| BORT_SYS_VNT      |
|    N7:17          |
|----] [------------+
|     10
|  [3]
```

Rung #054

```
|DWELL 5                                                                                         |
|CHAMBER                                                                                         |
|PRESSUR AT                                                                   CHAMBER VENT 4     |
|ATMOSPHERE                                                                   CLOSE DELAY        |
|PS5                                                                          CV4_DLY            |
|   I:036                                                                     +-TON-----------+  |
|----] [--------------------------------------------------------------------+-|TIMER ON DELAY |-(EN)-|
|    04                                                                       |TIMER:  T4:320 |  |
|                                                                             |BASE (SEC): 1.0|-(DN) |
| T4:320.DN - -] [- - File #2 MAIN_PRGRM - 55                                 |PRESET:      2 |  |
|                                                                             |ACCUM:       0 |  |
|                                                                             +---------------+  |
```

Rung #055

```
                                                                  OPEN
                                                                  DWELL 5
                                                                  VENT VALVE
 CV4_DLY                                                          CV4
  T4:320                                                           O:043
|---| |-------------------------------------------------------------(U)---|
      DN                                                            16
 [54]
                   O:043/16 - -| |- - File #5 FAULTS - 152
 MANUAL                                File #6 TECH_RUNGS - 0
 CONTROL                      -|/|- - File #2 MAIN_PRGRM - 368
 CHAMBER                               File #5 FAULTS - 154
 VENT VALVE                   -(L)- - File #2 MAIN_PRGRM - 403
 4 CLOSE
 M-CV4-0
    N7:4
|---| |---------
     3
 [3]
 BUFFER 3
 CHAMBER
 GATE VALVE   DOOR 8
 CLOSED       CLOSED
 HV8S1        DRCL8S
   I:040        I:042
|---|/|---------|/|---
    00           02
 DWELL 5
 CHAMBER
 GATE VALVE
 CLOSED
 HV9S1
   I:040
|---|/|---------
    03
 DWELL 6
 CHAMBER
 GATE VALVE
 CLOSED
 HV10S1
   I:052
|---|/|---------
    06
 BUFFER 4
 CHAMBER
 GATE VALVE
 CLOSED
 HV11S1
   I:054
|---|/|---------
    00
 ABORT SYSTEM
 VENT
 BORT_SYS_VNT
    N7:17
|---| |---------
     10
 [3]
```

Rung #056

```
OPEN ROUGHING VALVES 1->5 OP_RV1->5          B3    309   [104]
PUMP AREA 2 ENABLE PUMP2E                     N7:37 14    [438]
OPEN ROUGH VALVE 2,3,OR 4 DELAY P2-4RVTMR     T4:3  DN    [445]
MANUAL ROUGH PUMP VALVE 2 OPEN MRPV2OP        N7:28 1     [504]
CHROME CHAMBER =<250 MICRONS PIR6             I:024 /07
BLOWER 2 ENABLED BL2                          O:027 01    [74]
DWELL 1 CHAMBER VENT VALVE CLOSED CVS3        I:002 13
MECHANICAL PUMP 2 ISOLATION VALVE OPEN MP2IVOP I:025 13
OPEN DWELL 2 ROUGH VALVE RV2                  O:030 ( ) 11
```

```
O:030/11 - -| |- - File #5 FAULTS -  163
                   File #6 TECH_RUNGS -  0
           -|/|- - File #5 FAULTS -  165
           -( )- - File #2 MAIN_PRGRM -  56
```

Rung #057

```
OPEN ROUGHING VALVES 1->5 OP_RV1->5          B3    309   [104]
PUMP AREA 3 ENABLE PUMP3E                     N7:37 15    [442]
OPEN ROUGH VALVE 2,3,OR 4 DELAY P2-4RVTMR     T4:3  DN    [445]
MANUAL ROUGH PUMP VALVE 3 OPEN MRPV3OP        N7:28 2     [505]
MAGNETIC CHAMBER =<250 MICRONS PIR11          I:040 /07
BLOWER 2 ENABLED BL2                          O:027 01    [74]
DWELL 4 CHAMBER VENT VALVE CLOSED CVS5        I:022 11
MECHANICAL PUMP 2 ISOLATION VALVE OPEN MP2IVOP I:025 13
OPEN DWELL 4 ROUGH VALVE RV3                  O:044 ( ) 11
```

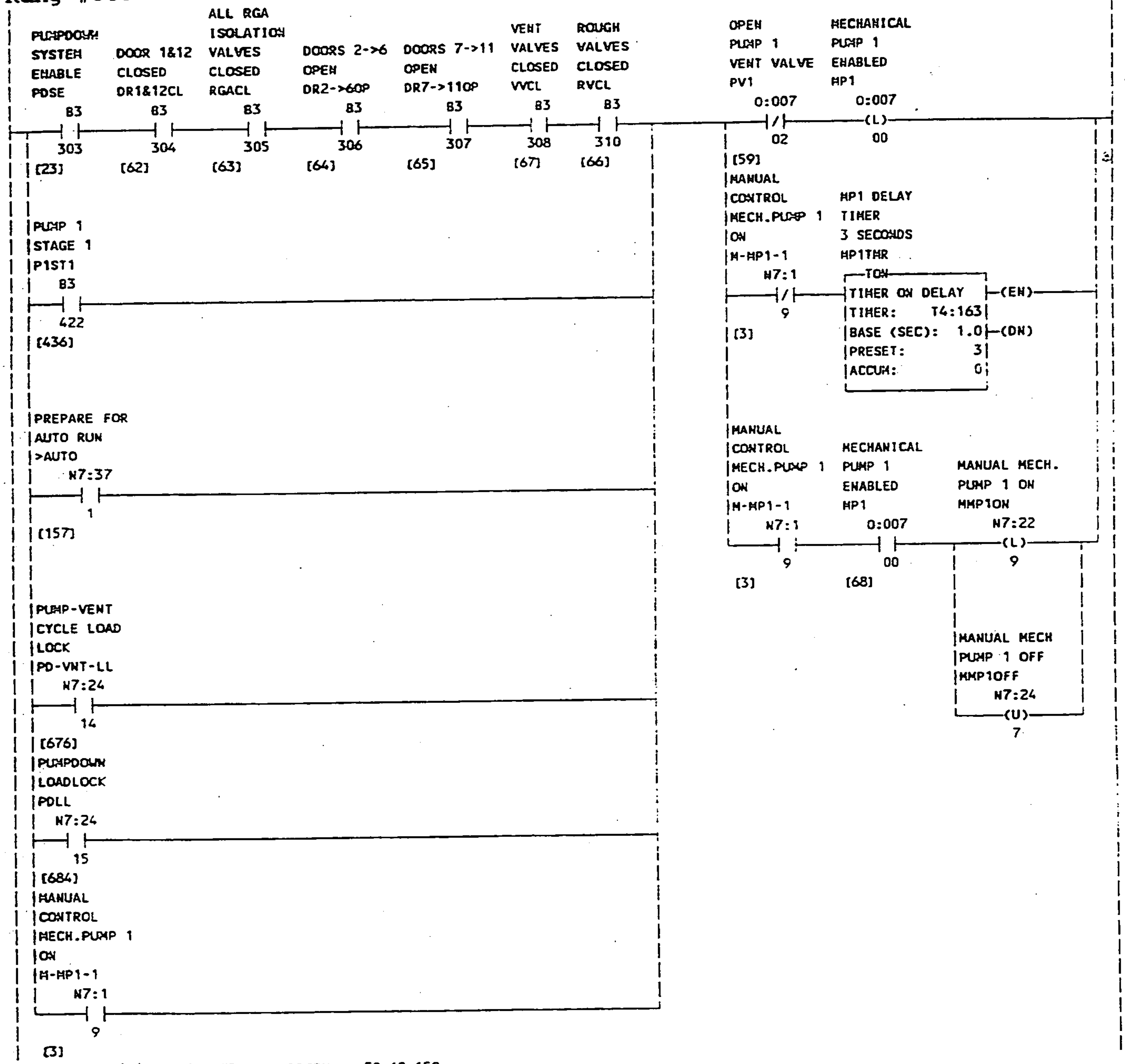
```
O:044/11 - -| |- - File #5 FAULTS -  167
                   File #6 TECH_RUNGS -  0
           -|/|- - File #5 FAULTS -  169
           -( )- - File #2 MAIN_PRGRM -  57
```

```
Rung #058
| OPEN                 CARBON              DWELL 5      MECHANICAL                     OPEN
| ROUGHING             CHAMBER             CHAMBER      PUMP 2                         DWELL 6
| VALVES               =<250    BLOWER 2   VENT VALVE   ISOLATION                      ROUGH
| 1->5                 MICRONS  ENABLED    CLOSED       VALVE OPEN                     VALVE
| OP_RV1->5            PIR16    BL2        CVS7         MP2IVOP                        RV4
|    B3                I:054    O:027      I:036        I:025                          O:060
|----] [-------------+--]/[------] [--------] [----------] [---------------------------( )---
|    309             |   07       01         11            13                           11
|[104]               |          [74]
| PUMP AREA   OPEN ROUGH
| 4 ENABLE    VALVE 2,3,OR
| PUMP4E      4 DELAY
|             P2-4RVTMR
|   N7:38      T4:3
|---] [--------] [---+
|    0          DN
| [447]       [445]
| MANUAL ROUGH
| PUMP VALVE
| 4 OPEN
| MRPV4OP
|   N7:28
|---] [--------------+
|     3
| [506]
O:060/11 - ] [ - File #5 FAULTS - 171
                 File #6 TECH_RUNGS - 0
           ]/[ - File #5 FAULTS - 173
           ( ) - File #2 MAIN_PRGRM - 58
Rung #059
|MECHANICAL                                                                OPEN
|PUMP 1                                                                    PUMP 1
|ENABLED                                                                   VENT VALVE
|MP1                                                                       PV1
|   O:007                                                                  O:007
|---] [--------------------------------------------------------------------( )---
|    00                                                                     02
|[68]
O:007/02 - ] [ - File #6 TECH_RUNGS - 1
           ]/[ - File #2 MAIN_PRGRM - 68
           ( ) - File #2 MAIN_PRGRM - 59
Rung #060
|MECHANICAL                                                                OPEN
|PUMP 2                                                                    PUMP 2
|ENABLED                                                                   VENT VALVE
|MP2                                                                       PV2
|   O:027                                                                  O:027
|---] [--------------------------------------------------------------------( )---
|    00                                                                     02
|[73]
O:027/02 - ] [ - File #6 TECH_RUNGS - 1
           ]/[ - File #2 MAIN_PRGRM - 73
           ( ) - File #2 MAIN_PRGRM - 60
Rung #061
|MECHANICAL                                                                OPEN
|PUMP 3                                                                    PUMP 3
|ENABLED                                                                   VENT VALVE
|MP3                                                                       PV3
|   O:057                                                                  O:057
|---] [--------------------------------------------------------------------( )---
|    00                                                                     02
|[78]
```

```
0:057/02 - -| |- - File #6 TECH_RUNGS    1
           -|/|- - File #2 MAIN_PRGRM -  78
           -( )- - File #2 MAIN_PRGRM -  61
Rung #062
|DOOR 1  DOOR 1  DOOR 12  DOOR 12                                          DOOR 1&12 |
|CLOSED  OPEN    CLOSED   OPEN                                             CLOSED    |
|DRCL1S  DROP1S  DRCL12S  DROP12S                                          DR1&12CL  |
| I:006  I:006   I:056    I:056                                            B3       |
|--| |----|/|-----| |------|/|----------------------------------------------( )-----|
|  00     01      06       07                                               304      |
B3/304 - -| |- - File #2 MAIN_PRGRM -  68
         -( )- - File #2 MAIN_PRGRM -  62
Rung #063
|                              RGA 2      RGA 2      RGA 3      RGA 3      RGA 4      RGA 4          ALL RGA    |
|                              ISOLATION  ISOLATION  ISOLATION  ISOLATION  ISOLATION  ISOLATION      ISOLATION  |
|RGA VALVE      RGA VALVE      VALVE      VALVE      VALVE      VALVE      VALVE      VALVE          VALVES     |
|SENSOR CLOSED  SENSOR OPEN    CLOSED     OPEN       CLOSED     OPEN       CLOSED     OPEN           CLOSED     |
|RGAS1_         RGAS2_         RGAS3      RGAS4      RGAS5      RGAS6      RGAS7      RGAS8          RGACL      |
|    I:005         I:005       I:025      I:025      I:041      I:041      I:055      I:055           B3       |
|------| |-----------|/|---------| |--------|/|--------| |--------|/|--------| |--------|/|-------------( )------|
|       16            17          16         17         16         17         16         17            305      |
B3/305 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  63
Rung #064
|DOOR 3  DOOR 3  DOOR 4  DOOR 4  DOOR 5  DOOR 5  DOOR 6  DOOR 6                       DOORS 2->6 |
|CLOSED  OPEN    CLOSED  OPEN    CLOSED  OPEN    CLOSED  OPEN                         OPEN       |
|DRCL3S  DROP3S  DRCL4S  DROP4S  DRCL5S  DROP5S  DRCL6S  DROP6S                       DR2->60P   |
| I:006  I:006   I:006   I:006   I:026   I:026   I:026   I:026                         B3        |
|--|/|-----| |-----|/|-----| |-----|/|-----| |-----|/|-----| |-------------------------( )-------|
|  04     05      06      07      00      01      02      03                          306       |
B3/306 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  64
Rung #065
|DOOR 7  DOOR 7  DOOR 8  DOOR 8  DOOR 9  DOOR 9  DOOR 10  DOOR 10                     DOORS 7->11 |
|CLOSED  OPEN    CLOSED  OPEN    CLOSED  OPEN    CLOSED   OPEN                        OPEN        |
|DRCL7S  DROP7S  DRCL8S  DROP8S  DRCL9S  DROP9S  DRCL10S  DROP10S                     DR7->110P   |
| I:042  I:042   I:042   I:042   I:056   I:056   I:056    I:056                        B3         |
|--|/|-----| |-----|/|-----| |-----|/|-----| |-----|/|------| |-----------------------( )--------|
|  00     01      02      03      00      01      02       03                         307        |
B3/307 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  65
Rung #066
|LLOCK    LLOCK    DWELL 2    DWELL 2  DWELL 4  DWELL 4  DWELL 5  DWELL 5  EXLOCK   EXLOCK                |
|CHAMBER  CHAMBER  CHAMBER    CHAMBER  CHAMBER  CHAMBER  CHAMBER  CHAMBER  CHAMBER  CHAMBER               |
|ROUGH    ROUGH    ROUGH      ROUGH    ROUGH    ROUGH    ROUGH    ROUGH    ROUGH    ROUGH        ROUGH    |
|VALVE    VALVE    VALVE RV2  VALVE    VALVE    VALVE    VALVE    VALVE    VALVE    VALVE        VALVES   |
|CLOSED   OPEN     CLOSED     OPEN     CLOSED   OPEN     CLOSED   OPEN     CLOSED   OPEN         CLOSED   |
|RVS1     RVS2     RVS3       RVS4     RVS5     RVS6     RVS7     RVS8     RVS9     RVS10        RVCL     |
|  I:002   I:002     I:022     I:022    I:036    I:036    I:052    I:052    I:052    I:052        B3      |
|----| |-----|/|-------| |--------|/|------| |------|/|------| |------|/|------| |------|/|--------( )-----|
|     15      16         15        16       15       16       14       15       16       17        310    |
B3/310 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  66
Rung #067
|OPEN        DWELL 1      DWELL 1      DWELL 4      DWELL 3      DWELL 5      DWELL 5      OPEN                   |
|LOAD LOCK   CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      EXLOCK         VENT    |
|CHAMBER     VENT VALVE   VENT VALVE   VENT VALVE   VENT VALVE   VENT VALVE   VENT VALVE   CHAMBER        VALVES  |
|VENT VALVE  CLOSED       OPEN         CLOSED       OPEN         CLOSED       OPEN         VENT VALVE     CLOSED  |
|CV1         CVS3         CVS4         CVS5         CVS6         CVS7         CVS8         CV5            VVCL    |
|  O:007       I:002        I:002        I:022        I:022        I:036        I:036        O:057         B3    |
|-----|/|--------| |----------|/|---------| |----------|/|---------| |----------|/|---------|/|---------( )-----|
|      16          13           14           11           12           11           12           16      308   |
|[173]                                                                             [346]                          |
```

B3/308 - -| |- - File #2 MAIN_PRGRM -
-( )- - File #2 MAIN_PRGRM - 67

Rung #068



0:007/00 - -| |- - File #2 MAIN_PRGRM - 59,69,158
File #5 FAULTS - 182
File #6 TECH_RUNGS - 0
-(L)- - File #2 MAIN_PRGRM - 68

```
          -(U)- - File #2 MAIN_PRGRM    89
T4:163.DN - -| |- - File #2 MAIN_PRGRM -  69,73,78
N7:22/9 - -(L)- - File #2 MAIN_PRGRM -  68
          -(U)- - File #2 MAIN_PRGRM -  89
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:24/7 - -(L)- - File #2 MAIN_PRGRM -  89
          -(U)- - File #2 MAIN_PRGRM -  68
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #069
|                MECHANICAL
| MP1 DELAY      PUMP 1        BLOWER 1                                          BLOWER 1
| TIMER          ENABLED       DISABLE                                           ENABLED
| MP1TMR         MP1           BL1D                                              BL1
|  T4:163         O:007         B3                                                O:007
|----| |---------| |-----------|/|--------------------------------------------------(L)----|
|       DN        00           122                                                  01
| [68]          [68]          [86]
|
|               O:007/01 - -| |- - File #2 MAIN_PRGRM - 70, 73, 158, 167, 455    MANUAL
| MANUAL                          File #5 FAULTS - 182                          CONTROL
| CONTROL                         File #6 TECH_RUNGS - 0                        BLOWER 1    MANUAL BLOWER
| BLOWER 1                  -|/|- - File #2 MAIN_PRGRM - 87, 89                 ON          1 ON
| ON                        -(U)- - File #2 MAIN_PRGRM - 86                     M-BL1-1     MBL1ON
| M-BL1-1       N7:22/12 - -(U)- - File #2 MAIN_PRGRM - 86                        N7:1          N7:22
|   N7:1        _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     ---| |-----------(L)---
|----| |------  N7:24/10 - -(L)- - File #2 MAIN_PRGRM - 86                         12            12
|     12        _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     [3]
| [3]
|                                                                                           MANUAL BLOWER
|                                                                                           1 OFF
|                                                                                           MBL1OFF
|                                                                                               N7:24
|                                                                                           -----(U)-----
|                                                                                                10
Rung #070
|                                                                              MP1 ISOL
| BLOWER 1                                                                     VALVE
| ENABLED                                                                      OPEN DELAY
| BL1                                                                          MP1IVOPDY
|  O:007                                                                       +--TON-------------+
|----| |-----------------------------------------------------------------------|TIMER ON DELAY    |-(EN)-
|     01                                                                       |TIMER:      T4:95 |
| [69]                                                                         |BASE (SEC):   1.0 |-(DN)
|                                                                              |PRESET:        10 |
|                                                                              |ACCUM:         10 |
|                                                                              +------------------+
T4:95.TT - -| |- - File #2 MAIN_PRGRM -  71
Rung #071
|                                                                              BLOWER 1
|                                                                              DELAY TO
|                                                                              START MP1IV
| MP1IVOPDY                                                                    BL1DLY
|  T4:95                                                                       +--TOF-------------+
|----| |-----------------------------------------------------------------------|TIMER OFF DELAY   |-(EN)-
|     TT                                                                       |TIMER:       T4:5 |
| [70]                                                                         |BASE (SEC):   1.0 |-(DN)
|                                                                              |PRESET:         5 |
|                                                                              |ACCUM:          5 |
|                                                                              +------------------+
T4:5.TT - -| |- - File #2 MAIN_PRGRM -  72
```

```
Rung #072
|                                                                    MECHANICAL PUMP |
|                                                                    1 ISOLATION     |
|                                                                    VALVE           |
|BL1DLY                                                              MP1IV           |
| T4:5                                                                     O:010     |
|--] [----------------------------------------------------------------------(L)------|
|   TT                                                                      03       |
|[71]
O:010/03 - -] [- - File #2 MAIN_PRGRM -  83
          -(L)- - File #2 MAIN_PRGRM -  72
          -(U)- - File #2 MAIN_PRGRM -  84
```

Rung #073

PUMPDOWN SYSTEM ENABLE PDSE
B3
303
[23]

BLOWER 1 ENABLED BL1
O:007
01
[69]

MP1 DELAY TIMER MP1TMR
T4:163
DN
[68]

PRGDONE
T4:130
TT
[3:262]

PUMP AREA 2 ENABLE PUMP2E
N7:37
14
[438]

PUMP AREA 3 ENABLE PUMP3E
N7:37
15
[442]

PUMP AREA 4 ENABLE PUMP4E
N7:38
0
[447]

SIEVE TRAP MECH PUMP ENABLE SVMPEN
B3
125
[3:263]

MANUAL CONTROL MECH.PUMP 2 ON M-MP2-1
N7:1
10
[3]

OPEN PUMP 2 VENT VALVE PV2
O:027
-|/|-
02
[60]

MECHANICAL PUMP 2 ENABLED MP2
O:027
-(L)-
00

MANUAL CONTROL MECH.PUMP 2 ON M-MP2-1
N7:1
-|/|-
10
[3]

MECHANICAL PUMP 2 TIMER MP2TMR
TON
TIMER ON DELAY
TIMER: T4:165
BASE (SEC): 1.0
PRESET: 3
ACCUM: 0
-(EN)-
-(DN)

MANUAL CONTROL MECH.PUMP 2 ON M-MP2-1
N7:1
10
[3]

MECHANICAL PUMP 2 ENABLED MP2
O:027
00
[73]

MANUAL MECH. PUMP 2 ON MMP2ON
N7:22
-(L)-
10

MANUAL MECH. PUMP 2 OFF MP2OFF
N7:24
-(U)-
8

```
O:027/00 - -| |- - File #2 MAIN_PRGRM    60,74
                   File #5 FAULTS -  184
                   File #6 TECH_RUNGS -  0,15
          -(L)- - File #2 MAIN_PRGRM -  73
          -(U)- - File #2 MAIN_PRGRM -  96
T4:165.DN - -| |- - File #2 MAIN_PRGRM -  74,78
N7:22/10 - -(L)- - File #2 MAIN_PRGRM -  73
          -(U)- - File #2 MAIN_PRGRM -  96
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
N7:24/8 - -(L)- - File #2 MAIN_PRGRM -  96
         -(U)- - File #2 MAIN_PRGRM -  73
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #074

```
            MECHANICAL
 BLOWER 2   PUMP 2      BLOWER 2                              BLOWER 2
 DELAY      ENABLED     DISABLE                               ENABLED
 MP2TMR     MP2         BL2D                                  BL2
  T4:165    O:027       B3                                     O:027
|--| |-----+--| |--------|/|------------------------------+-----(L)------+--|
|| DN      |  00         123                             |      01      |
||[73]     | [73]        [93]                            |              |
||         |                                             |MANUAL        |
||         | O:027/01 - -| |- - File #2 MAIN_PRGRM - 56, 57, 58, 74, 75, 78,
||MANUAL   |                   445                       |CONTROL
||CONTROL  |              File #3 CRYO_REGEN - 10, 11, 15, 16, 117, 118,
||BLOWER 2 |              119, 120, 121, 122, 123, 124, 125, 126, 127,
||ON       |              128, 129, 130, 131, 132, 133, 134, 135, 136,
||M-BL2-1  |              137, 138, 139, 140, 141, 164, 165, 166, 167,
||  N7:1   |              168, 169, 170, 171, 172, 173, 174, 175, 177,
|+--| |----+              179, 181, 183, 185, 187
|    13                   File #5 FAULTS - 184
|  [3]                    File #6 TECH_RUNGS - 0, 15
|                -|/|- - File #2 MAIN_PRGRM - 94, 96
|          -(U)- - File #2 MAIN_PRGRM - 93
| N7:22/13 - -(U)- - File #2 MAIN_PRGRM - 93
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2
| N7:24/11 - -(L)- - File #2 MAIN_PRGRM - 93
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2

                       |MANUAL
                       |CONTROL
                       |BLOWER 2  BLOWER 2   MANUAL BLOWER
                       |ON        ENABLED    2 ON
                       |M-BL2-1   BL2        MBL2ON
                       |  N7:1    O:027        N7:22
                       +--| |------| |-----+----(L)----+
                           13       01     |    13     |
                       [3]      [74]       |           |
                                           |MANUAL BLOWER
                                           |2 OFF      |
                                           |MBL2OFF    |
                                           |   N7:24   |
                                           +----(U)----+
                                                11
```

Rung #075

```
|BLOWER 2                                            MP2 ISOL
|ENABLED                                             VALVE
|BL2                                                 OPEN DELAY
| O:027                                              MP2IVOPDY
|                                                    +--TON---------------+
|--| |-----------------------------------------------|TIMER ON DELAY      |-(EN)-|
|   01                                               |TIMER:        T4:96 |
|[74]                                                |BASE (SEC):    1.0  |-(DN)
|                                                    |PRESET:         10  |
|                                                    |ACCUM:           0  |
|                                                    +--------------------+
T4:96.TT - -| |- - File #2 MAIN_PRGRM -  76
```

Rung #076

```
|                                                    BLOWER 2
|                                                    DELAY TO
|                                                    START MP2IV
|MP2IVOPDY                                           BL2DLY
| T4:96                                              +--TOF---------------+
|--| |-----------------------------------------------|TIMER OFF DELAY     |-(EN)-|
|   TT                                               |TIMER:        T4:10 |
|[75]                                                |BASE (SEC):    1.0  |-(DN)
|                                                    |PRESET:         48  |
|                                                    |ACCUM:          48  |
|                                                    +--------------------+
```

```
T4:10.TT - -| |- - File #2 MAIN_PRGRM    7
           -|/|- - File #2 MAIN_PRGRM -  91
```

Rung #077

```
|                                                          MECHANICAL PUMP |
|                                                          2 ISOLATION     |
|                                                          VALVE           |
|BL2DLY                                                    MP2IV           |
| T4:10                                                       O:030        |
|-| |----------------------------------------------------------(L)---------|
|   TT                                                          03         |
|[76]                                                                      |
O:030/03 - -| |- - File #2 MAIN_PRGRM -  90
           -(L)- - File #2 MAIN_PRGRM -  77
           -(U)- - File #2 MAIN_PRGRM -  91
```

Rung #078

```
PUMPDOWN
SYSTEM     BLOWER 2   BLOWER 2                         OPEN         MECHANICAL
ENABLE     ENABLED    DELAY                            PUMP 3       PUMP 3
PDSE       BL2        MP2TMR                           VENT VALVE   ENABLED
                                                       PV3          MP3
  B3       O:027      T4:165                           O:057        O:057
--] [------] [--------] [------------------------------]/[----------(L)--
  303       01          DN                               02           00
[23]       [74]        [73]                            [61]
                                                       MANUAL
                                                       CONTROL       BLOWER 3
PUMP AREA                                              MECH.PUMP 3   ON DELAY
5 ENABLE                                               ON            TIMER
PUMP5E                                                 M-MP3-1       BL3DY
  N7:38                                                  N7:1        +--TON-----------------+
--] [--                                                --]/[---------|TIMER ON DELAY        |-(EN)-
   1                                                     11          |TIMER:         T4:167 |
[451]                                                  [3]           |BASE (SEC):       1.0 |-(DN)
                                                                     |PRESET:             3 |
                                                                     |ACCUM:              0 |
PREPARE FOR  MP1 DELAY                                               +----------------------+
AUTO RUN     TIMER
>AUTO        MP1TMR                                    MANUAL
  N7:37       T4:163                                   CONTROL       MECHANICAL
--] [--------] [--                                     MECH.PUMP 3   PUMP 3        MANUAL MECH.
   1           DN                                      ON            ENABLED       PUMP 3 ON
[157]         [68]                                     M-MP3-1       MP3           MMP3ON
                                                         N7:1        O:057           N7:22
                                                       --] [---------] [-------------(L)--
VENT-PUMP                                                11            00              11
CYCLE EXIT                                             [3]           [78]
LOCK
VNT-PD-EX                                                                          MANUAL MECH.
  N7:27                                                                            PUMP 3 OFF
--] [--                                                                            MMP3OFF
   9                                                                                 N7:24
[690]                                                                              --(U)--
PUMP DOWN                                                                              9
EXIT LOCK
PDEX
  N7:27
--] [--
   10
[698]
MANUAL
CONTROL
MECH.PUMP 3
ON
M-MP3-1
  N7:1
--] [--
   11
[3]
```

```
O:057/00 - -] [- - File #2 MAIN_PRGRM -  61,79,158
                   File #5 FAULTS -  186
                   File #6 TECH_RUNGS -  0
           -(L)- - File #2 MAIN_PRGRM -  78
           -(U)- - File #2 MAIN_PRGRM -  103
T4:167.DN - -] [- - File #2 MAIN_PRGRM -  79
N7:22/11 - -(L)- - File #2 MAIN_PRGRM -  78
```

```
        -(U)- - File #2 MAIN_PRGRM    103
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
N7:24/9 - -(L)- - File #2 MAIN_PRGRM -  103
        -(U)- - File #2 MAIN_PRGRM -  78
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #079
|                 MECHANICAL
| BLOWER 3        PUMP 3      BLOWER 3                                         BLOWER 3
| ENABLE DELAY    ENABLED     DISABLE                                          ENABLED
| BL3DY           MP3         BL3D                                             BL3
|    T4:167         O:057        B3                                             O:057
|------] [----------] [---------]/[----------------------------------------------+---(L)----+
| |      DN      |    00         124                                            |   01      |
| |[78]          | [78]        [100]                                            |           |
| |              |                                                              |MANUAL     |
| |              | O:057/01 - ] [ - File #2 MAIN_PRGRM - 79, 80, 158, 340, 456  |CONTROL    |
| |MANUAL        |                File #5 FAULTS - 186                          |BLOWER 3  BLOWER 3   MANUAL BLOWER
| |CONTROL       |                File #6 TECH_RUNGS - 0                        |ON        ENABLED    3 ON
| |BLOWER 3      |           ]/[ - File #2 MAIN_PRGRM - 101, 103                |M-BL3-1   BL3        MB3ON
| |ON            |           -(U)- - File #2 MAIN_PRGRM - 100                   |  N7:1    O:057        N7:22
| |M-BL3-1       | N7:22/14 - -(U)- - File #2 MAIN_PRGRM - 100                  +---] [-----] [----+-----(L)----+
| |   N7:1       | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                      14        01    |      14
| +---] [--------+ N7:24/12 - -(L)- - File #2 MAIN_PRGRM - 100                  [3]       [79]    |
|      14          _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                      |
|  [3]                                                                                              |MANUAL BLOWER
|                                                                                                   |3 OFF
|                                                                                                   |MBL3OFF
|                                                                                                   |    N7:24
|                                                                                                   +-----(U)-----
|                                                                                                          12
Rung #080
|                                                                                  MP3 ISOL.
|BLOWER 3                                                                          VALVE
|ENABLED                                                                           OPEN DELAY
|BL3                                                                               MP3IVOPDY
| O:057                                                                            +-TON-----------------+
|---] [----------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|   01                                                                             |TIMER:         T4:97 |
|[79]                                                                              |BASE (SEC):      1.0 +-(DN)
|                                                                                  |PRESET:           10 |
|                                                                                  |ACCUM:            10 |
|                                                                                  +---------------------+
T4:97.TT - ] [ - File #2 MAIN_PRGRM -  81
Rung #081
|                                                                                  BLOWER 3
|                                                                                  DELAY TO
|                                                                                  START MP3IV
|MP3IVOPDY                                                                         BL3DLY
|  T4:97                                                                           +-TOF-----------------+
|---] [----------------------------------------------------------------------------+TIMER OFF DELAY      +-(EN)-
|    TT                                                                            |TIMER:        T4:164 |
|[80]                                                                              |BASE (SEC):      1.0 +-(DN)
|                                                                                  |PRESET:            5 |
|                                                                                  |ACCUM:             5 |
|                                                                                  +---------------------+
T4:164.TT - ] [ - File #2 MAIN_PRGRM -  82
```

```
Rung #082                                                            MECHANICAL PUMP |
|                                                                    3 ISOLATION     |
|                                                                    VALVE           |
|                                                                    MP3IV           |
|BL3DLY                                                                 0:060        |
| T4:164                                                                             |
|-] [------------------------------------------------------------------(L)----------|
|  TT                                                                    03          |
|[81]                                                                                |
0:060/03 - -] [- - File #2 MAIN_PRGRM -  97
           -(L)- - File #2 MAIN_PRGRM -  82
           -(U)- - File #2 MAIN_PRGRM -  98
Rung #083                                                                            |
|MANUAL                                                                BLOWER 1      |
|CONTROL   MECHANICAL PUMP                                             MANUAL OFF    |
|BLOWER 1  1 ISOLATION                                                 PULSE         |
|OFF       VALVE                                                       BL1MANOFF     |
|M-BL1-0   MP1IV                                                          B3         |
|  N7:3        0:010                                                                 |
|---] [----------] [---------------------------------------------------(L)----------|
|   10          03                                                       317         |
|[3]       [84]                                                                      |
B3/317 - -]/[- - File #2 MAIN_PRGRM -  89
         -(L)- - File #2 MAIN_PRGRM -  83
         -(U)- - File #2 MAIN_PRGRM -  88
```

```
Rung #084
                                   LLOCK
 MANUAL                            CHAMBER                                MECHANICAL PUMP
 CONTROL                           ROUGH                                  1 ISOLATION
 BLOWER 1                          VALVE                                  VALVE
 OFF                               CLOSED                                 MP1IV
 N-BL1-O                           RVS1                                        O:010
   N7:3                              I:002
|--| |----------------------------+--| |------------------------------------(U)---
    10                                 15                                       03
 [3]
                                  O:010/03 - -| |- - File #2 MAIN_PRGRM - 83
                                          -(L)- - File #2 MAIN_PRGRM - 72

 AUTO OFF
 PULSE
 AUOFPULSE
  T4:283
|----| |-------------------------|
       TT
 [155]
 PUMP1EDPLSE
   T4:284
|------| |-----------------------|
         TT
 [437]
 PDSOPLSE
  T4:285
|----| |-------------------------|
      TT
 [22]
 SYSTEM
 VENT
 ENABLE
 PULSE
 SYSVNTPLSE
  +--LEQ-----------------------+
 -|LESS THAN OR EQUAL (A<=B)   |-
  |SOURCE A:            T4:286 |
  |                        606 |
  |SOURCE B:                 3 |
  |                          3 |
  +----------------------------+
 T4:286 - [370]
 PUMPDOWN
 LOADLOCK    AUTO
 DISABLE     MODE
 PULSE       ENABLE
 PDLLDPLSE   AUTO
  T4:287     N7:37
 +----| |------|/|-----------------+
       TT        11
   [686]       [155]
Rung #085
 MECH. PUMP 1
 ISOL. VALVE                                                    UNLATCH BL1
 CLOSE SENSOR                                                   PULSE
 MP1IVCL                                                        UNL_BL1_PL
      I:005                                                     +--TON--------------+
|-------| |-----------------------------------------------------|TIMER ON DELAY     |-(EN)-
        14                                                      |TIMER:      T4:289 |
                                                                |BASE (SEC):    1.0 |-(DN)
 T4:289.TT - -| |- - File #2 MAIN_PRGRM - 86                    |PRESET:         10 |
                                                                |ACCUM:           0 |
>                                                               >>>>>>>>>>>>>>>>>>>     >
```

```
Rung #086                                                                  BLOWER 1
                                                                           ENABLED
                                                                           BL1
|UNL_BL1_PL                                                                  O:007
|  T4:289                                                              +----(U)----+
|----| |--------------------------------------------------------------+     01    |
|     TT                                                               |           |
|[85]                                                                  |           |
| O:007/01 - -| |- - File #2 MAIN_PRGRM - 70, 73, 158, 167, 455       |BLOWER 1   |
|                    File #5 FAULTS - 182                              |DISABLE    |
|                    File #6 TECH_RUNGS - 0                            |BL1D       |
|           -|/|- - File #2 MAIN_PRGRM - 87, 89                       |  B3       |
|           -(L)- - File #2 MAIN_PRGRM - 69                           +--( )------+
| B3/122 - -|/|- - File #2 MAIN_PRGRM - 69                            |  122      |
| N7:22/12 - -(L)- - File #2 MAIN_PRGRM - 69                          |           |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |           |
| N7:24/10 - -(U)- - File #2 MAIN_PRGRM - 69                          |           |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |MANUAL BLOWER
|                                                                      |1 ON       |
|                                                                      |MBL1ON     |
|                                                                      |   N7:22   |
|                                                                      +----(U)----+
|                                                                      |    12     |
|                                                                      |MANUAL BLOWER
|                                                                      |1 OFF      |
|                                                                      |MBL1OFF    |
|                                                                      |   N7:24   |
|                                                                      +----(L)----+
|                                                                           10
Rung #087                                                        BLOWER 1
|                                                                OFF-AUTO
|BLOWER 1                                                        PULSE
|ENABLED                                                         BL1OFFPLSE
|BL1                                                             +--TON----------------+
| O:007                                                          |                     |
|----|/|---------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|     01                                                         |TIMER:        T4:292 |
|[86]                                                            |BASE (SEC):     1.0  +-(DN)
|                                                                |PRESET:           8  |
|                                                                |ACCUM:            0  |
|                                                                +---------------------+
T4:292.DN - -| |- - File #2 MAIN_PRGRM - 88
T4:292.TT - -| |- - File #2 MAIN_PRGRM - 89
Rung #088                                                                  BLOWER 1
|                                                                          MANUAL OFF
|                                                                          PULSE
|                                                                          BL1MANOFF
|BL1OFFPLSE                                                                   B3
|  T4:292                                                                 ---(U)---
|----| |------------------------------------------------------------------    317
|     DN
|[87]
B3/317 - -|/|- - File #2 MAIN_PRGRM - 89
         -(L)- - File #2 MAIN_PRGRM - 83
         -(U)- - File #2 MAIN_PRGRM - 88
```

```
Rung #089
|          BLOWER 1                                                      MECHANICAL    |
|          MANUAL OFF    BLOWER 1                                        PUMP 1        |
|          PULSE         ENABLED                                         ENABLED       |
| BL1OFFPLSE BL1MANOFF   BL1                                             MP1           |
|  T4:292     B3          O:007                                           O:007        |
|----| |------|/|-------+---|/|---------------------------------------+----(U)------+-|
| |    TT      317      |    01                                      |     00      | |
| |[87]        [88]     | [86]                                       |             | |
| |MANUAL               | O:007/00 - -| |- - File #2 MAIN_PRGRM - 59, 68, 69, 158    | |
| |CONTROL              |                    File #5 FAULTS - 182    |MANUAL MECH. | |
| |MECHANICAL           |                    File #6 TECH_RUNGS - 0  |PUMP 1 ON    | |
| |PUMP 1               |              -(L)- - File #2 MAIN_PRGRM - 68 |MMP1ON     | |
| |OFF                  | N7:22/9 - -(L)- - File #2 MAIN_PRGRM - 68  |   N7:22     | |
| |M-MP1-0              | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2 +----(U)------+ |
| |   N7:3              | N7:24/7 - -(U)- - File #2 MAIN_PRGRM - 68  |     9       | |
| +----| |--------------+ _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2 |             | |
|       7                                                            |             | |
| [3]                                                                |MANUAL MECH  | |
|                                                                    |PUMP 1 OFF   | |
|                                                                    |MMP1OFF      | |
|                                                                    |   N7:24     | |
|                                                                    +----(L)------+ |
|                                                                          7
Rung =090
|MANUAL
|CONTROL   MECHANICAL PUMP                                             BLOWER 2
|BLOWER 2  2 ISOLATION                                                 MANUAL OFF  |
|OFF       VALVE                                                       PULSE       |
|M-BL2-0   MP2IV                                                       BL2MANOFF   |
|  N7:3        C:030                                                     B3        |
|----| |---------| |-----------------------------------------------------(L)-------|
|     11         C3                                                      318       |
|[3]    [91]                                                                       |
B3/318 - -|/|- - File #2 MAIN_PRGRM - 96
         -(L)- - File #2 MAIN_PRGRM - 90
         -(U)- - File #2 MAIN_PRGRM - 95
```

```
Rung #091
                                      DWELL 2     DWELL 4   DWELL 5
                                      CHAMBER     CHAMBER   CHAMBER                                        MECHANICAL PUMP
                                      ROUGH       ROUGH     ROUGH                                          2 ISOLATION
                                      VALVE RV2   VALVE     VALVE                                          VALVE
                                      CLOSED      CLOSED    CLOSED                                         MP2IV
  PDSDPLSE                            RVS3        RVS5      RVS7                                              O:030
   T4:285                               I:022      I:036     I:052
|--] [----------------------------+------] [--------] [-------] [------------------------------------------(U)------|
|    TT                           |       15         15        14                                            03
| [22]                            |
|                                 | O:030/03 - ] [ - - File #2 MAIN_PRGRM - 90
|                                 |            -(L)- - File #2 MAIN_PRGRM - 77
|DISABLE                          |
|MP2 & BL2                        |
|CRMPBL2D                         |
|  T4:170                         |
|--] [----------------------------|
|    TT                           |
|[3:261]                          |
|SYSTEM                           |
|VENT                             |
|ENABLE                           |
|PULSE                            |
|SYSVNTPLSE                       |
| +-LEQ-----------------------+   |
|-|LESS THAN OR EQUAL (A<=B)  |---|
| |SOURCE A:           T4:286 |   |
| |                       606 |   |
| |SOURCE B:                3 |   |
| |                         3 |   |
| +---------------------------+   |
|T4:286 - [370]                   |
|P2ENDPULSE                       |
|  T4:125                         |
|--] [----------------------------|
|    TT                           |
|[441]                            |
|P3ENDPULSE                       |
|  T4:126                         |
|--] [----------------------------|
|    TT                           |
|[446]                            |
|P4ENDPULSE                       |
|  T4:127                         |
|--] [----------------------------|
|    TT                           |
|[450]                            |
|NO CRYOS BEING  ABORT CRYO       |
|REGENERATED     TIMER            |
|NO_CYRGN        ABORTCRYO        |
|    B3            T4:297         |
|----] [-----------] [------------|
|    233            TT            |
|[3:33]          [3:27]           |
|                SIEVE TRAP       |
|NO CRYOS BEING  MECH PUMP        |
|REGENERATED     DISABLE          |
|NO_CYRGN        SVMPDIS   BL2DLY |
|    B3            B3      T4:10  |
|----]/[-----------] [------]/[---|
|    233           102       TT   |
|[3:33]          [3:264]    [76]  |
> >                               >
```

```
< <
| |MANUAL                                   |
| |CONTROL                                  |
| |BLOWER 2                                 |
| |OFF                                      |
| |M-BL2-O                                  |
| |  N7:3                                   |
| |---] [-----------------------------------|
|      11
| (3)
Rung #092
|MECHANICAL PUMP
|2 ISOLATION
|VALVE CLOSE                                                          UNLATCH BL2
|SENSOR                                                               PULSE
|MP2IVCL                                                              UNL_BL2_PL
|      I:025                                                          +-TON-----------------+
|-------] [-----------------------------------------------------------|TIMER ON DELAY       |-(EN)-
|       14                                                            |TIMER:      T4:290   |
|                                                                     |BASE (SEC):    1.0   |-(DN)
| T4:290.TT - ] [ - File #2 MAIN_PRGRM - 93                           |PRESET:         10   |
|                                                                     |ACCUM:          10   |
|                                                                     +---------------------+
Rung #093
|                                                                          BLOWER 2
|                                                                          ENABLED
|UNL_BL2_PL                                                               BL2
|  T4:290                                                                   O:027
|----] [--------------------------------------------------------------------+--(U)----
|     TT                                                                   |   01
|(92)                                                                      |
| O:027/01 - ] [ - File #2 MAIN_PRGRM - 56, 57, 58, 74, 75, 78, 445        |
|                  File #3 CRYO_REGEN - 10, 11, 15, 16, 117, 118, 119, 120, 121, 122, 123, 124,   |BLOWER 2
|                  125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139,     |DISABLE
|                  140, 141, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 177,     |BL2D
|                  179, 181, 183, 185, 187                                 |    B3
|                  File #5 FAULTS - 184                                    |---( )---
|                  File #6 TECH_RUNGS - 0, 15                              |   123
|           ]/[ - File #2 MAIN_PRGRM - 94, 96                              |
|           -(L)- - File #2 MAIN_PRGRM - 74                                |
| B3/123 - ]/[ - File #2 MAIN_PRGRM - 74                                   |
| N7:24/11 - -(U)- - File #2 MAIN_PRGRM - 74                               |MANUAL BLOWER
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                              |2 OFF
| N7:22/13 - -(L)- - File #2 MAIN_PRGRM - 74                               |MBL2OFF
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                              |    N7:24
|                                                                          |----(L)----
|                                                                          |    11
|                                                                          |MANUAL BLOWER
|                                                                          |2 ON
|                                                                          |MBL2ON
|                                                                          |    N7:22
|                                                                          +----(U)----
|                                                                               13
```

```
Rung #094
                                                                BLOWER 2
|BLOWER 2                                                       OFF-AUTO
|ENABLED                                                        PULSE
|BL2                                                            BL2OFFPLSE
|  O:027                                                        +--TON--------------+
|--|/|----------------------------------------------------------|TIMER ON DELAY     |-(EN)-
|  01                                                           |TIMER:    T4:293   |
|[93]                                                           |BASE (SEC):   1.0  |-(DN)
|                                                               |PRESET:         5  |
|                                                               |ACCUM:          5  |
|                                                               +-------------------+
T4:293.DN - -| |- - File #2 MAIN_PRGRM -  95
T4:293.TT - -| |- - File #2 MAIN_PRGRM -  96
Rung #095
                                                                BLOWER 2
|                                                               MANUAL OFF
|                                                               PULSE
|BL2OFFPLSE                                                     BL2MANOFF
|  T4:293                                                       B3
|--| |------------------------------------------------------------(U)---
|  DN                                                           318
|[94]
B3/318 - -|/|- - File #2 MAIN_PRGRM -  96
         -(L)- - File #2 MAIN_PRGRM -  90
         -(U)- - File #2 MAIN_PRGRM -  95
Rung #096
|               BLOWER 2                                        MECHANICAL
|               MANUAL OFF    BLOWER 2                          PUMP 2
|               PULSE         ENABLED                           ENABLED
| BL2OFFPLSE    BL2MANOFF     BL2                               MP2
|  T4:293       B3            O:027                             O:027
|---| |---------|/|-----------|/|-------------------------------+--(U)--+
| |  TT         318         |  01                               |  00   |
| |[94]         [95]        | [93]                              |       |
| |MANUAL                   | O:027/00 - -| |- - File #2 MAIN_PRGRM - 60, 73, 74
| |CONTROL                  |                  File #5 FAULTS - 184   |MANUAL MECH.
| |MECHANICAL               |                  File #6 TECH_RUNGS - 0, 15  |PUMP 2 ON
| |PUMP 2                   |           -(L)- - File #2 MAIN_PRGRM - 73    |MMP2ON
| |OFF                      | N7:22/10 - -(L)- - File #2 MAIN_PRGRM - 73   |  N7:22
| |M-MP2-O                  | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  +--(U)--+
| |  N7:3                   | N7:24/8 - -(U)- - File #2 MAIN_PRGRM - 73    |  10   |
| +--| |--------------------+ _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
|    8                                                          |MANUAL MECH.
|  [3]                                                          |PUMP 2 OFF
|                                                               |MP2OFF
|                                                               |  N7:24
|                                                               +--(L)--+
|                                                                  8
Rung #097
|MANUAL
|CONTROL   MECHANICAL PUMP                                      BLOWER 3
|BLOWER 3  3 ISOLATION                                          MANUAL OFF
|OFF       VALVE                                                PULSE
|M-BL3-O   MP3IV                                                BL3MANOFF
|  N7:3      O:060                                              B3
|--| |--------| |---------------------------------------------------(L)---
|  12         03                                                319
|[3]        [98]
B3/319 - -|/|- - File #2 MAIN_PRGRM -  103
```

```
      -(L)- - File #2 MAIN_PRGRM -
      -(U)- - File #2 MAIN_PRGRM - 102
Rung #098
|                                   EXLOCK                                          |
| SYSTEM                            CHAMBER                                         |
| VENT                              ROUGH                      MECHANICAL PUMP      |
| ENABLE                            VALVE                      3 ISOLATION          |
| PULSE                             CLOSED                     VALVE                |
| SYSVNTPLSE                        RVS9                       MP3IV                |
| +-LEQ--------------------+          I:052                         O:060          |
|-+|LESS THAN OR EQUAL (A<=B)|--+----| |--------------------------------(U)--------|
| ||SOURCE A:        T4:286|  |      16                                 03          |
| ||                    606|  |                                                     |
| ||SOURCE B:             3|  | O:060/03 - -| |- - File #2 MAIN_PRGRM - 97          |
| ||                      3|  |            -(L)- - File #2 MAIN_PRGRM - 82          |
| |+-----------------------+  |                                                     |
| |T4:286 - [370]             |                                                     |
| |MANUAL                     |                                                     |
| |CONTROL                    |                                                     |
| |BLOWER 3                   |                                                     |
| |OFF                        |                                                     |
| |M-BL3-0                    |                                                     |
| |   N7:3                    |                                                     |
| |---| |---------------------|                                                     |
| |   12                      |                                                     |
| |[3]                        |                                                     |
| |AUTO OFF                   |                                                     |
| |PULSE                      |                                                     |
| |AUOFPULSE                  |                                                     |
| |  T4:283                   |                                                     |
| |----| |--------------------|                                                     |
| |    TT                     |                                                     |
| |[155]                      |                                                     |
| |P5ENDPULSE                 |                                                     |
| |   T4:128                  |                                                     |
| |----| |--------------------|                                                     |
| |    TT                     |                                                     |
| |[454]                      |                                                     |
| |PDSDPLSE                   |                                                     |
| |  T4:285                   |                                                     |
| |---| |---------------------|                                                     |
| |    TT                     |                                                     |
| |[22]                       |                                                     |
| |           AUTO            |                                                     |
| |           MODE            |                                                     |
| |           ENABLE          |                                                     |
| |PFEXEND    AUTO            |                                                     |
| | T4:222    N7:37           |                                                     |
| +---| |------|/|------------+                                                     |
|     TT        11                                                                  |
|  [699]      [155]                                                                 |
Rung #099
|MECHANICAL PUMP                                                                    |
|3 ISOL. VALVE                                          UNLATCH BL3                 |
|CLOSE SENSOR                                           PULSE                       |
|MP3IVCL                                                UNL_BL3_PL                  |
|      I:055                                            +-TON-----------------+      |
|--------| |--------------------------------------------|TIMER ON DELAY       |-(EN)-|
|        15                                             |TIMER:        T4:291|      |
|                                                       |BASE (SEC):      1.0|-(DN) |
| T4:291.TT - -| |- - File #2 MAIN_PRGRM - 100          |PRESET:           20|      |
|                                                       |ACCUM:             0|      |
|                                                       +--------------------+      |
```

```
Rung #100
                                                                    BLOWER 3
                                                                    ENABLED
UNL_BL3_PL                                                          BL3
  T4:291                                                              0:057
|----| |--------------------------------------------------------------+--(U)--+--|
      TT                                                              |   01  |
[99]                                                                  |       |
0:057/01 - -| |- - File #2 MAIN_PRGRM - 79, 80, 158, 340, 456         |BLOWER 3
                   File #5 FAULTS - 186                               |DISABLE
                   File #6 TECH_RUNGS - 0                             |BL3D
            -|/|- - File #2 MAIN_PRGRM - 101, 103                     |   B3
            -(L)- - File #2 MAIN_PRGRM - 79                           +--( )--+
B3/124 - -|/|- - File #2 MAIN_PRGRM - 79                              |  124  |
N7:22/14 - -(L)- - File #2 MAIN_PRGRM - 79                            |       |
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                           |       |
N7:24/12 - -(U)- - File #2 MAIN_PRGRM - 79                            |       |
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                           |MANUAL BLOWER
                                                                      |3 ON
                                                                      |MB3ON
                                                                      |   N7:22
                                                                      +---(U)-+
                                                                      |    14 |
                                                                      |MANUAL BLOWER
                                                                      |3 OFF
                                                                      |MBL3OFF
                                                                      |   N7:24
                                                                      +---(L)-+
                                                                           12
Rung #101
                                                                 BLOWER 3
BLOWER 3                                                         OFF-AUTO
ENABLED                                                          PULSE
BL3                                                              BL3OFFPLSE
  0:057                                                          +-TON-----------------+
|----|/|---------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
      01                                                         |TIMER:       T4:294 |
[100]                                                            |BASE (SEC):     1.0 +-(DN)
                                                                 |PRESET:           5 |
                                                                 |ACCUM:            0 |
                                                                 +--------------------+
T4:294.DN - -| |- - File #2 MAIN_PRGRM - 102
T4:294.TT - -| |- - File #2 MAIN_PRGRM - 103
Rung #102
                                                                           BLOWER 3
                                                                           MANUAL OFF
                                                                           PULSE
BL3OFFPLSE                                                                 BL3MANOFF
  T4:294                                                                      B3
|----| |-------------------------------------------------------------------(U)-----|
      DN                                                                      319
[101]
B3/319 - -|/|- - File #2 MAIN_PRGRM - 103
         -(L)- - File #2 MAIN_PRGRM - 97
         -(U)- - File #2 MAIN_PRGRM - 102
```

Rung #103

```
           BLOWER 3                                                          MECHANICAL
           MANUAL OFF  BLOWER 3                                              PUMP 3
           PULSE       ENABLED                                               ENABLED
 BL3OFFPLSE BL3MANOFF  BL3                                                   MP3
  T4:294      B3       O:057                                                  O:057
---] [--------]/[-------]/[-----------------------------------------------------(U)---
    TT       319       01                                                       00
 [101]      [102]      [100]
 MANUAL                O:057/00 - ] [ - File #2 MAIN_PRGRM - 61, 78, 79, 158
 CONTROL                          File #5 FAULTS - 186                        MANUAL MECH.
 MECHANICAL                       File #6 TECH_RUNGS - 0                      PUMP 3 ON
 PUMP 3                    -(L)- - File #2 MAIN_PRGRM - 78                    MMP3ON
 OFF                   N7:22/11 - -(L)- - File #2 MAIN_PRGRM - 78              N7:22
 M-MP3-O               _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          ---(U)---
   N7:3                N7:24/9 - -(U)- - File #2 MAIN_PRGRM - 78                 11
---] [-----------      _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2
    9
 [3]                                                                          MANUAL MECH.
                                                                              PUMP 3 OFF
                                                                              MMP3OFF
                                                                                N7:24
                                                                             ---(L)---
                                                                                 9
```

Rung #104

```
 PUMPDOWN                                                                     OPEN
 SYSTEM    OPEN ROUGHING                                                      ROUGHING
 ENABLE    VALVES DELAY                                                       VALVES
 PDSE      DROP2_DLY                                                          1->5
   B3         T4:169                                                          OP_RV1->5
                                                                                 B3
---] [-------] [-------------------------------------------------------------( )---
   303         DN                                                               309
 [23]       [199]
                       B3/309 - ] [ - File #2 MAIN_PRGRM - 56, 57, 58, 167, 340
            AUTO
            MODE
            ENABLE
            AUTO
             N7:37
          ---]/[-------
              11
            [155]
```

```
Rung #105
|                  LLOCK                                                                   |
|                  CHAMBER  HEATER 1                                                        |
|                  ROUGH    CHAMBER                                                         |
|                  VALVE    =<250                                               AREA 1 AT  |
| PUMP AREA        CLOSED   MICRONS                                             STANDBY    |
| 1 ENABLE         RVS1     PIR2                                                1STANDBY   |
| PUMP1E                                                                          B3       |
|   N7:37           I:002    I:004                                                        |
|-+---] [-----+-----] [------] [----------------------------------------------------(L)----|
| |    13     |     15       10                                                    291     |
| |[434]      |                                                                            |
| |           | B3/291 - -] [- - File #2 MAIN_PRGRM - 115, 117, 118                        |
| |           |         -(U)- - File #2 MAIN_PRGRM - 110                                   |
| |RV'S ALL   |                                                                            |
| |CLOSED FOR |                                                                            |
| |CROSSOVER  |                                                                            |
| |RVS_CLOSED |                                                                            |
| |    B3     |                                                                            |
| +---] [-----+                                                                            |
| |   176     |                                                                            |
| |[24]       |                                                                            |
| |AUTO OFF   |                                                                            |
| |PULSE      |                                                                            |
| |AUOFPULSE  |                                                                            |
| |  T4:283   |                                                                            |
| +---] [-----+                                                                            |
|      TT                                                                                  |
|  [155]
Rung #106
|                  DWELL 2                                                                 |
|                  CHAMBER   CHROME                                                        |
|                  ROUGH     CHAMBER                                                       |
| PUMP AREA        VALVE RV2 =<250                                               AREA 2    |
| 2 ENABLE         CLOSED    MICRONS                                             AT STANDBY|
| PUMP2E           RVS3      PIR6                                                2STANDBY  |
|   N7:37           I:022     I:024                                                B3     |
|-+---] [-----+-----] [-------] [---------------------------------------------------(L)----|
| |    14     |     15        07                                                   292     |
| |[438]      |                                                                            |
| |           | B3/292 - -] [- - File #2 MAIN_PRGRM - 117, 118, 119, 120, 121, 122, 123, 124
| |           |         -(U)- - File #2 MAIN_PRGRM - 111                                   |
| |RV'S ALL   |                                                                            |
| |CLOSED FOR |                                                                            |
| |CROSSOVER  |                                                                            |
| |RVS_CLOSED |                                                                            |
| |    B3     |                                                                            |
| +---] [-----+                                                                            |
| |   176     |                                                                            |
| |[24]       |                                                                            |
| |AUTO OFF   |                                                                            |
| |PULSE      |                                                                            |
| |AUOFPULSE  |                                                                            |
| |  T4:283   |                                                                            |
| +---] [-----+                                                                            |
|      TT                                                                                  |
|  [155]
```

```
Rung #107
          DWELL 4
          CHAMBER   MAGNETIC
          ROUGH     CHAMBER
PUMP AREA VALVE     =<250                                   AREA 3
3 ENABLE  CLOSED    MICRONS                                 AT STANDBY
PUMP3E    RVS5      PIR11                                   3STANDBY
  N7:37    I:036     I:040                                    B3
--| |------| |-------| |-----------------------------------(L)--
   15       15        07                                      293
[442]
          B3/293 - -| |- - File #2 MAIN_PRGRM - 125, 126, 127, 128, 129, 130
                   -(U)- - File #2 MAIN_PRGRM - 112
RV'S ALL
CLOSED FOR
CROSSOVER
RVS_CLOSED
   B3
--| |--
  176
[24]
AUTO OFF
PULSE
AUOFPULSE
  T4:283
--| |--
   TT
[155]
Rung #108
          DWELL 5
          CHAMBER   CARBON
          ROUGH     CHAMBER
PUMP AREA VALVE     =<250                                   AREA 4
4 ENABLE  CLOSED    MICRONS                                 AT STANDBY
PUMP4E    RVS7      PIR16                                   4STANDBY
  N7:38    I:052     I:054                                    B3
--| |------| |-------| |-----------------------------------(L)--
   0        14        07                                      294
[447]
          B3/294 - -| |- - File #2 MAIN_PRGRM - 131, 132, 133, 134, 135, 136
                   -(U)- - File #2 MAIN_PRGRM - 113
RV'S ALL
CLOSED FOR
CROSSOVER
RVS_CLOSED
   B3
--| |--
  176
[24]
AUTO OFF
PULSE
AUOFPULSE
  T4:283
--| |--
   TT
[155]
```

```
Rung #109
|
|                                      EXLOCK
|                                      CHAMBER  EXIT BUFFER
|                                      ROUGH    CHAMBER                                              AREA 5        |
|  PUMP AREA                           VALVE    =<250                                                AT STANDBY    |
|  5 ENABLE                            CLOSED   MICRONS                                              5STANDBY      |
|  PUMP5E                              RVS9     PIR15                                                     B3       |
|     N7:38                              I:052     I:040                                                           |
|-+-----] [----------------------+-------] [-------] [-------------------------------------------------(L)--------|
| |      1                       |        16        13                                                295        |
| |[451]                         |                                                                              |
| |                              | B3/295 - ] [ - File #2 MAIN_PRGRM - 137, 138                                 |
| |                              |         -(U)- - File #2 MAIN_PRGRM - 114                                     |
| |RV'S ALL                      |                                                                              |
| |CLOSED FOR                    |                                                                              |
| |CROSSOVER                     |                                                                              |
| |RVS_CLOSED                    |                                                                              |
| |      B3                      |                                                                              |
| |-----] [----------------------|                                                                              |
| |     176                      |                                                                              |
| |[24]                          |                                                                              |
| |AUTO OFF                      |                                                                              |
| |PULSE                         |                                                                              |
| |AUOFPULSE                     |                                                                              |
| |  T4:283                      |                                                                              |
| |-----] [----------------------|                                                                              |
| |      TT                      |                                                                              |
| |[155]                         |                                                                              |
| |              PUMPDOWN        |                                                                              |
| |              EXIT LOCK       |                                                                              |
| |PUMP DOWN     5STANDBY        |                                                                              |
| |EXIT LOCK     ENABLE OS       |                                                                              |
| |PDEX          PDEX5SE         |                                                                              |
| |   N7:27          B3          |                                                                              |
| +-----]/[---------[ONS]--------+                                                                              |
|        10         248                                                                                         |
|  [698]
```

```
Rung #110
| SYSTEM                                                                              |
| VENT                                                                     AREA 1 AT  |
| ENABLE                                                                   STANDBY    |
| SYSVNTE                                                                  1STANDBY   |
|   N7:37                                                                     B3      |
|-+--| |--+---------------------------------------------------------------------(U)--|
| |   5    |                                                                   291    |
| |[368]   |                                                                          |
| |        | B3/291 - -| |- - File #2 MAIN_PRGRM - 115, 117, 118                      |
| |        |          -(L)- - File #2 MAIN_PRGRM - 105                                |
| |VENT AREA|                                                                         |
| |1 ENABLE |                                                                         |
| |VENT1E   |                                                                         |
| |  N7:37  |                                                                         |
| |---| |---|                                                                         |
| |    6    |                                                                         |
| |[405]    |                                                                         |
| |PREPARE FOR                                                                        |
| |AUTO RUN |                                                                         |
| |>AUTO    |                                                                         |
| |   N7:37 |                                                                         |
| |-----| |-|                                                                         |
| |      1  |                                                                         |
| |[157]    |                                                                         |
| |reset    |                                                                         |
| |RESET    |                                                                         |
| | N7:17   |                                                                         |
| |-| |-----|                                                                         |
| |  15     |                                                                         |
| |[3]      |                                                                         |
| |COMPRESSOR                                                                         |
| |2 REGEN- |                                                                         |
| |ERATION  |                                                                         |
| |PROGRAM  |                                                                         |
| |CYRGN2   |                                                                         |
| |    B3   |                                                                         |
| +---| |---+                                                                         |
|     322                                                                             |
|  [3:34]                                                                             |
```

```
Rung #111
| SYSTEM                                                                   AREA 2       |
| VENT                                                                     AT STANDBY   |
| ENABLE                                                                   2STANDBY     |
| SYSVNTE                                                                     B3        |
|   N7:37                                                                               |
|--+----| |----+--------------------------------------------------------------(U)------|
|  |     5     |                                                               292      |
|  |[368]      |                                                                        |
|  |           | B3/292 - -| |- - File #2 MAIN_PRGRM - 117, 118, 119, 120, 121, 122, 123, 124
|  |           |            -(L)- - File #2 MAIN_PRGRM - 106                            |
|  |           |                                                                        |
|  |VENT AREA  |
|  |2 ENABLE   |
|  |VENT2E     |
|  |   N7:37   |
|  |----| |----|
|  |     7     |
|  |[411]      |
|  |PREPARE FOR|
|  |AUTO RUN   |
|  |>AUTO      |
|  |    N7:37  |
|  |----| |----|
|  |      1    |
|  |[157]      |
|  |reset      |
|  |RESET      |
|  | N7:17     |
|  |--| |------|
|  |  15       |
|  |[3]        |
|  |COMPRESSOR |
|  |3 REGEN-   |
|  |ERATION    |
|  |PROGRAM    |
|  |CYRGN3     |
|  |     B3    |
|  |----| |----|
|  |    323    |
|  |[3:38]     |
|  |COMPRESSOR |
|  |4 REGEN-   |
|  |ERATION    |
|  |PROGRAM    |
|  |CYRGN4     |
|  |     B3    |
|  |----| |----|
|  |    324    |
|  |[3:42]     |
|  |COMPRESSOR |
|  |5 REGEN-   |
|  |ERATION    |
|  |PROGRAM    |
|  |CYRGN5     |
|  |     B3    |
|  +----| |----+
|       325
|  [3:46]
```

Rung #112

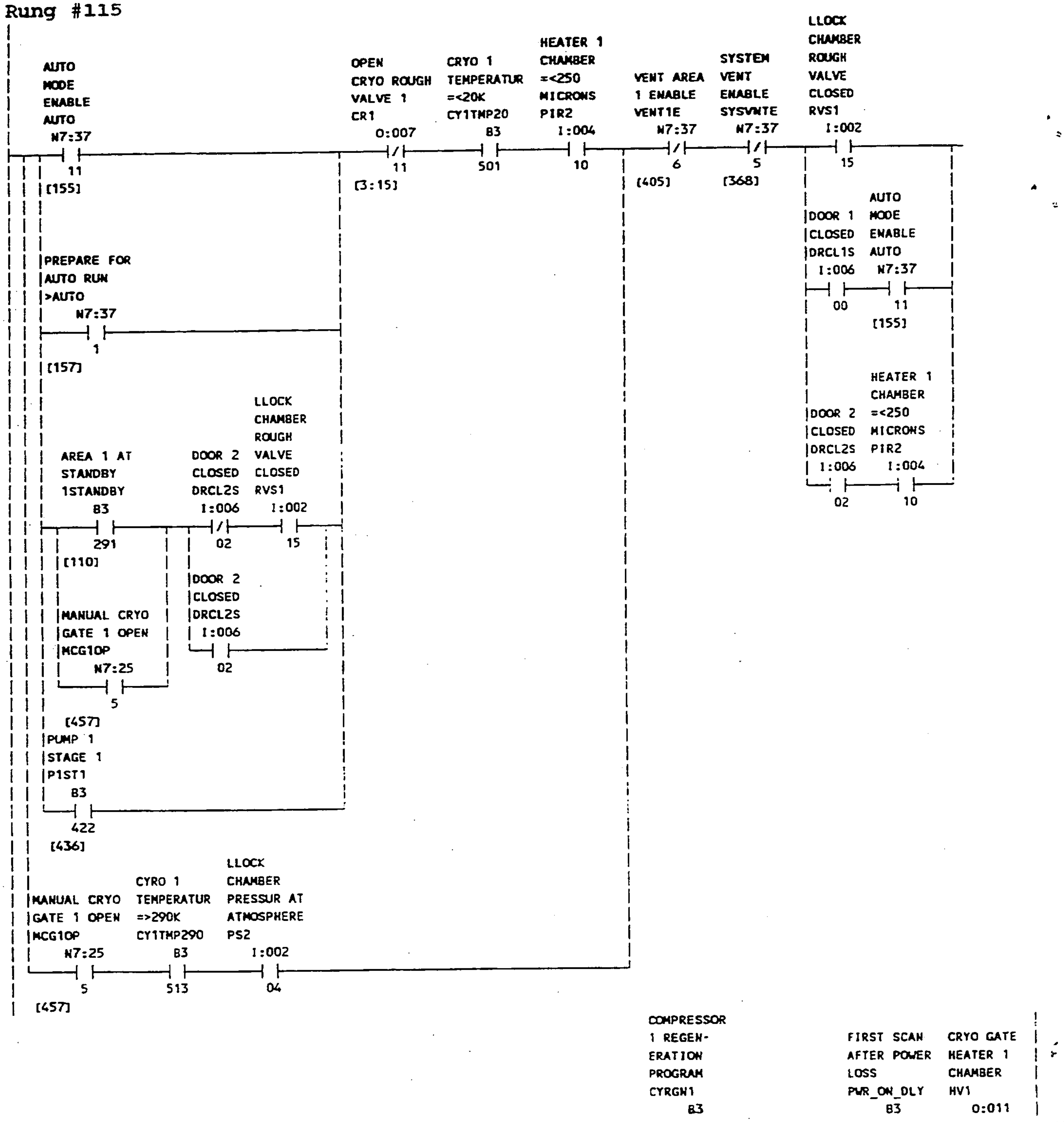
```
| SYSTEM                                                                     AREA 3      |
| VENT                                                                       AT STANDBY  |
| ENABLE                                                                     3STANDBY    |
| SYSVNTE                                                                       B3       |
|  N7:37                                                                                 |
|---] [---+------------------------------------------------------------------(U)--------|
|    5    |                                                                   293        |
| [368]   |                                                                              |
|         | B3/293 - ] [ - File #2 MAIN_PRGRM - 125, 126, 127, 128, 129, 130            |
|         |        -(L)- - File #2 MAIN_PRGRM - 107                                      |
|VENT AREA|                                                                              |
|3 ENABLE |                                                                              |
|VENT3E   |                                                                              |
|  N7:37  |                                                                              |
|---] [---|                                                                              |
|    8    |                                                                              |
|[418]    |                                                                              |
|PREPARE FOR                                                                             |
|AUTO RUN |                                                                              |
|>AUTO    |                                                                              |
|  N7:37  |                                                                              |
|---] [---|                                                                              |
|    1    |                                                                              |
|[157]    |                                                                              |
|reset    |                                                                              |
|RESET    |                                                                              |
| N7:17   |                                                                              |
|---] [---|                                                                              |
|   15    |                                                                              |
|[3]      |                                                                              |
|COMPRESSOR                                                                              |
|5 REGEN- |                                                                              |
|ERATION  |                                                                              |
|PROGRAM  |                                                                              |
|CYRGN5   |                                                                              |
|   B3    |                                                                              |
|---] [---|                                                                              |
|   325   |                                                                              |
|[3:46]   |                                                                              |
|COMPRESSOR                                                                              |
|6 REGEN- |                                                                              |
|ERATION  |                                                                              |
|PROGRAM  |                                                                              |
|CYRGN6   |                                                                              |
|   B3    |                                                                              |
|---] [---+                                                                              |
|   326                                                                                  |
|  [3:52]                                                                                |
```

```
Rung #113
| SYSTEM                                                                            AREA 4     |
| VENT                                                                              AT STANDBY |
| ENABLE                                                                            4STANDBY   |
| SYSVNTE                                                                             B3       |
|  N7:37                                                                                       |
|-+--] [---+-----------------------------------------------------------------------(U)------|
| |   5    |                                                                      294        |
| |[368]   |                                                                                 |
| |        | B3/294 - -] [- - File #2 MAIN_PRGRM - 131, 132, 133, 134, 135, 136             |
| |        |          -(L)- - File #2 MAIN_PRGRM - 108                                       |
| |VENT AREA|                                                                                |
| |4 ENABLE |                                                                                |
| |VENT4E   |                                                                                |
| |  N7:37  |                                                                                |
| |---] [---|                                                                                |
| |    9    |                                                                                |
| |[425]    |                                                                                |
| |PREPARE FOR|                                                                              |
| |AUTO RUN |                                                                                |
| |>AUTO    |                                                                                |
| |   N7:37 |                                                                                |
| |---] [---|                                                                                |
| |     1   |                                                                                |
| |[157]    |                                                                                |
| |reset    |                                                                                |
| |RESET    |                                                                                |
| | N7:17   |                                                                                |
| |-] [-----|                                                                                |
| |  15     |                                                                                |
| |[3]      |                                                                                |
| |COMPRESSOR|                                                                               |
| |7 REGEN- |                                                                                |
| |ERATION  |                                                                                |
| |PROGRAM  |                                                                                |
| |CYRGN7   |                                                                                |
| |    B3   |                                                                                |
| |---] [---|                                                                                |
| |   327   |                                                                                |
| |[3:57]   |                                                                                |
| |COMPRESSOR|                                                                               |
| |8 REGEN- |                                                                                |
| |ERATION  |                                                                                |
| |PROGRAM  |                                                                                |
| |CYRGN8   |                                                                                |
| |    B3   |                                                                                |
| +---] [---+                                                                                |
|     328                                                                                    |
|  [3:63]                                                                                    |
```

Rung #114

```
| SYSTEM                                                                    |
| VENT                                                           AREA 5     |
| ENABLE                                                         AT STANDBY |
| SYSVNTE                                                        5STANDBY   |
|   N7:37                                                           B3      |
|-+--] [--+---------------------------------------------------------(U)-----|
| |   5    |                                                         295     |
| |[368]   |                                                                 |
| |        | B3/295 - ] [ - File #2 MAIN_PRGRM - 137, 138                    |
| |        |          -(L)- - File #2 MAIN_PRGRM - 109                       |
| |VENT AREA                                                                 |
| |5 ENABLE|                                                                 |
| |VENT5E  |                                                                 |
| |  N7:37 |                                                                 |
| |---] [--|                                                                 |
| |   10   |                                                                 |
| |[430]   |                                                                 |
| |PREPARE FOR                                                               |
| |AUTO RUN|                                                                 |
| |>AUTO   |                                                                 |
| |  N7:37 |                                                                 |
| |---] [--|                                                                 |
| |    1   |                                                                 |
| |[157]   |                                                                 |
| |reset   |                                                                 |
| |RESET   |                                                                 |
| | N7:17  |                                                                 |
| |-] [----|                                                                 |
| |  15    |                                                                 |
| |[3]     |                                                                 |
| |COMPRESSOR                                                                |
| |7 REGEN-|                                                                 |
| |ERATION |                                                                 |
| |PROGRAM |                                                                 |
| |CYRGN7  |                                                                 |
| |    B3  |                                                                 |
| +---] [--+                                                                 |
|     327                                                                    |
|  [3:57]                                                                    |
```

Rung #115


AUTO MODE ENABLE AUTO N7:37 11 [155]
OPEN CRYO ROUGH VALVE 1 CR1 0:007 11 [3:15]
CRYO 1 TEMPERATUR =<20K CY1TMP20 B3 501
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
VENT AREA 1 ENABLE VENT1E N7:37 6 [405]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15
DOOR 1 CLOSED DRCL1S I:006 00
AUTO MODE ENABLE AUTO N7:37 11 [155]
DOOR 2 CLOSED DRCL2S I:006 02
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
PREPARE FOR AUTO RUN >AUTO N7:37 1 [157]
AREA 1 AT STANDBY 1STANDBY B3 291 [110]
DOOR 2 CLOSED DRCL2S I:006 02
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15
DOOR 2 CLOSED DRCL2S I:006 02
MANUAL CRYO GATE 1 OPEN MCG1OP N7:25 5 [457]
PUMP 1 STAGE 1 P1ST1 B3 422 [436]
MANUAL CRYO GATE 1 OPEN MCG1OP N7:25 5 [457]
CYRO 1 TEMPERATUR =>290K CY1TMP290 B3 513
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04
COMPRESSOR 1 REGEN- ERATION PROGRAM CYRGN1 B3
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3
CRYO GATE HEATER 1 CHAMBER HV1 0:011
>>>>>>> >>>>>>>>>>>>>>>>>>>>>>>>>>> >>>>>>>>>> >>>>>

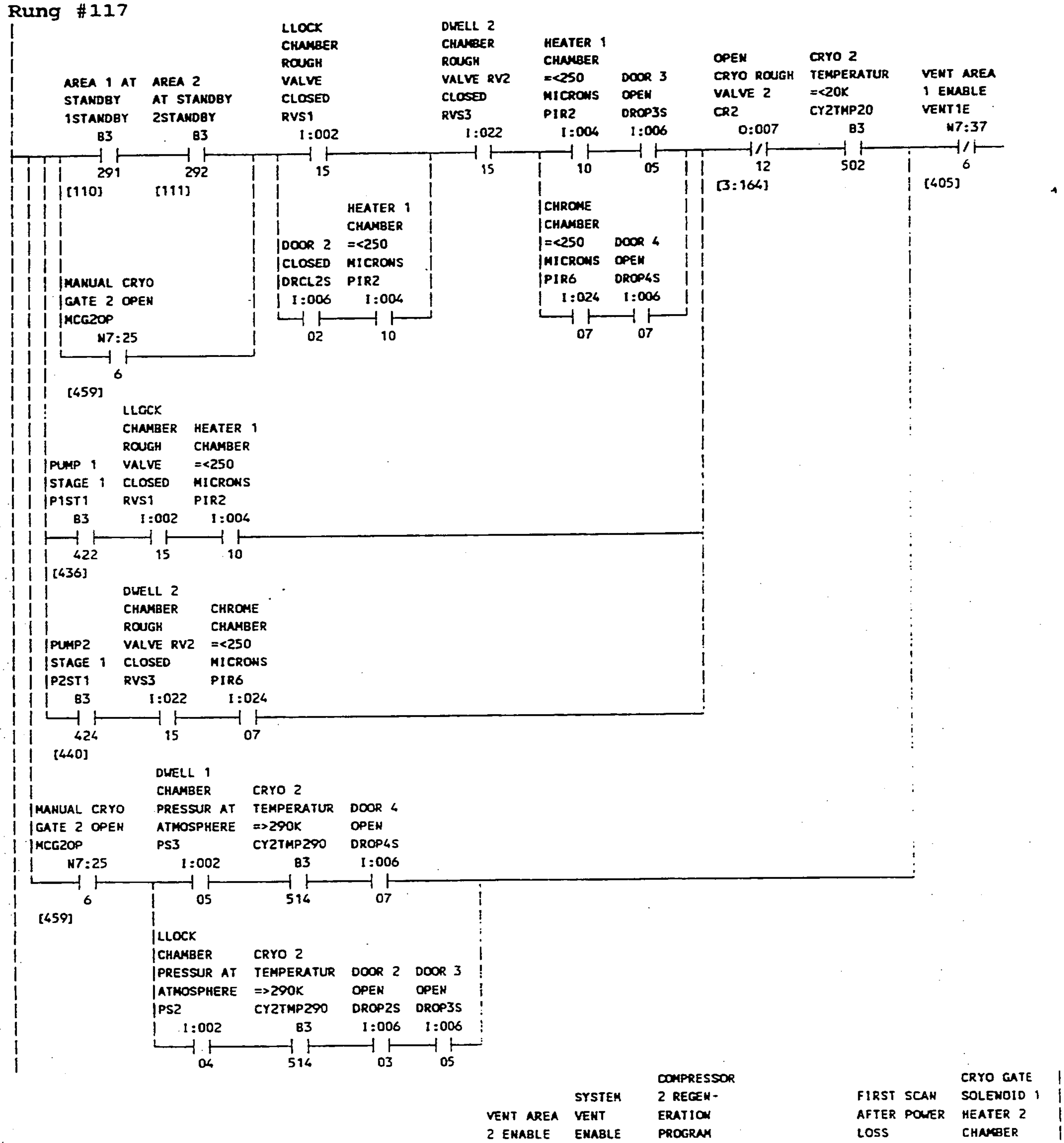
```
<<<<<<< <<<<<<   <<<<<<<<<<<<<<<< <<<<<<<<<<< <<<<<
 ──┤/├──          ─────────┬───┤/├──────( )──┤
 | 321                     |   444      11   |
 |[3:0]                    | [1]             |
 |COMPRESSOR               |                 |
 |1 REGEN-                 |                 |
 |ERATION     COOL DOWN    |                 |
 |PROGRAM     1            |                 |
 |CYRGN1      CD1          |                 |
 |   B3          B3        |                 |
 └──┤ ├─────────┤ ├────────┘                 |
   321          651                          |
  [3:0]        [3:20]                        |

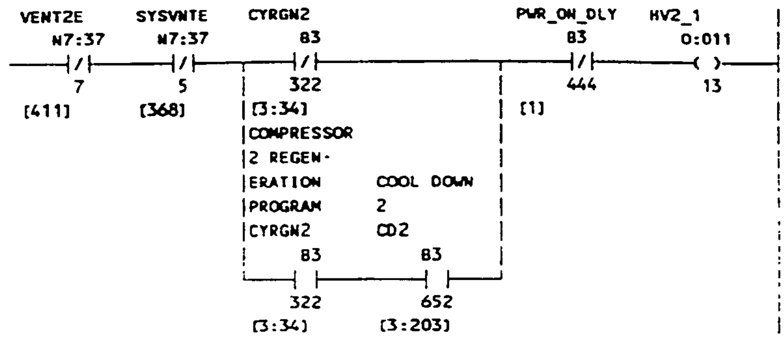
0:011/11 - ┤ ├ - File #5 FAULTS - 69
                 File #6 TECH_RUNGS - 6
           ┤/├ - File #5 FAULTS - 117
           ( ) - File #2 MAIN_PRGRM - 115
```

Rung #116

```
| DOOR 3                                                      HEATER 1      |
| CLOSED                                                      HIVAC BAFFLE  |
| DRCL3S                                                      HV1_2         |
|  I:006                                                         O:011      |
├─┬──┤ ├──┬───────────────────────────────────────────────────────(U)───────┤
| |   04  |                                                        12       |
| |       | O:011/12 - ┤ ├ - File #2 MAIN_PRGRM - 379
| |AUTO   |            ┤/├ - File #2 MAIN_PRGRM - 38
| |MODE   |            -(L)- - File #2 MAIN_PRGRM - 215
| |ENABLE |
| |AUTO   |
| | N7:37 |
| └──┤/├──┘
|     11
|  [155]
```

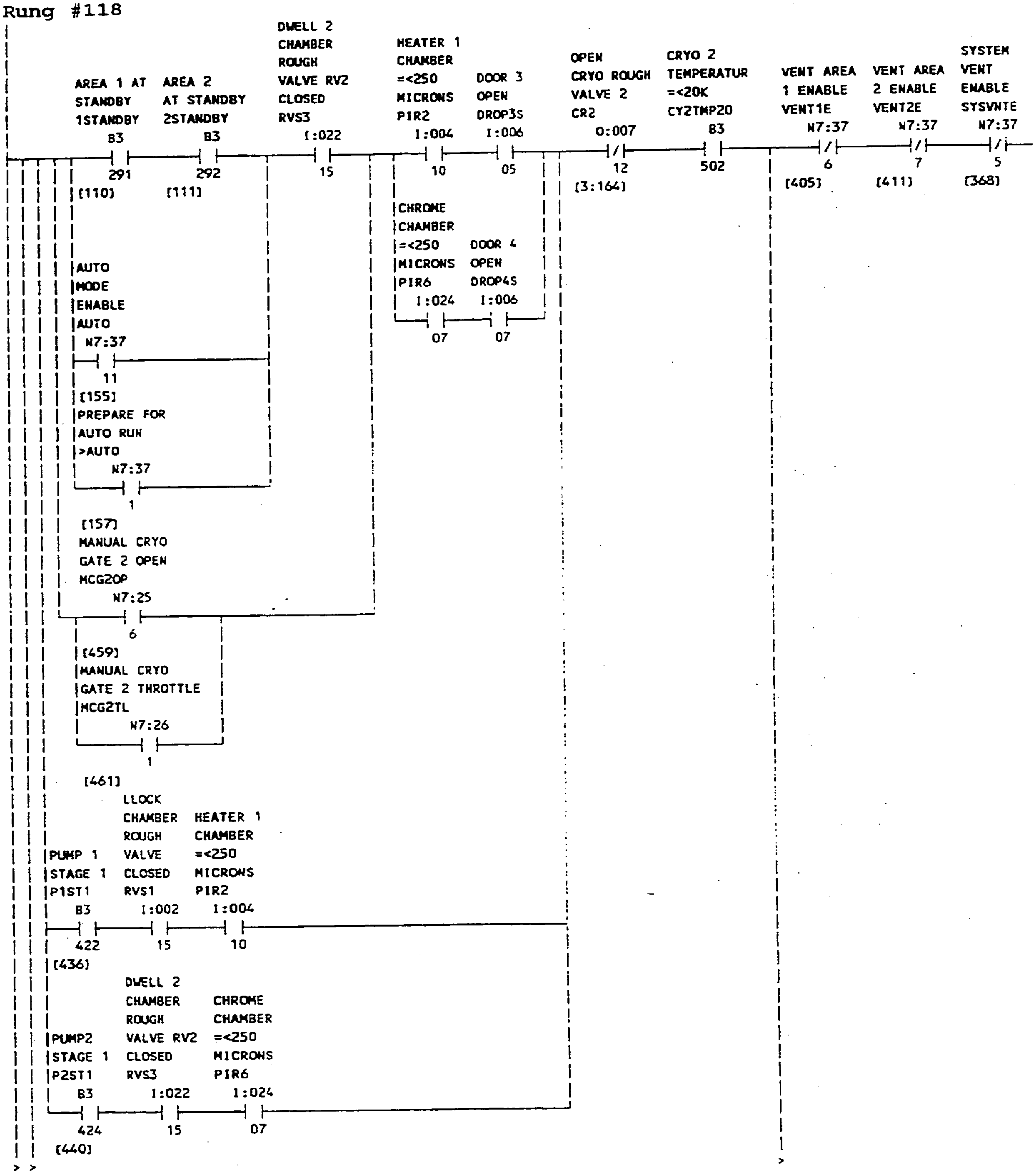
Rung #117

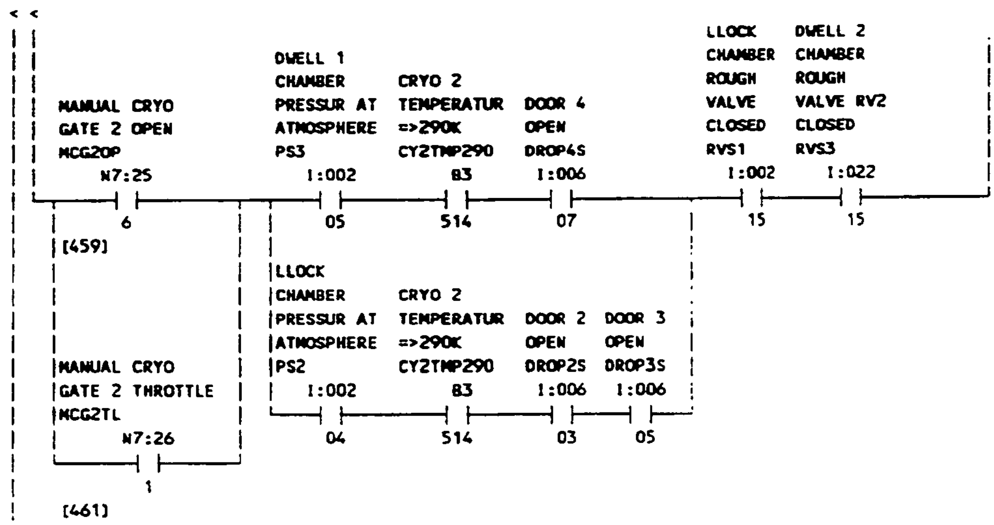

LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3
HEATER 1 CHAMBER =<250 MICRONS PIR2
DOOR 3 OPEN DROP3S
OPEN CRYO ROUGH VALVE 2 CR2
CRYO 2 TEMPERATUR =<20K CY2TMP20
VENT AREA 1 ENABLE VENT1E
AREA 1 AT STANDBY 1STANDBY
AREA 2 AT STANDBY 2STANDBY
B3 291
B3 292
I:002 15
I:022 15
I:004 10
I:006 05
O:007 12
B3 502
N7:37 6
[110]
[111]
[3:164]
[405]
HEATER 1 CHAMBER =<250 MICRONS PIR2
DOOR 2 CLOSED DRCL2S
I:006 02
I:004 10
CHROME CHAMBER =<250 MICRONS PIR6
DOOR 4 OPEN DROP4S
I:024 07
I:006 07
MANUAL CRYO GATE 2 OPEN MCG2OP
N7:25 6
[459]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
HEATER 1 CHAMBER =<250 MICRONS PIR2
PUMP 1 STAGE 1 P1ST1
B3 422
I:002 15
I:004 10
[436]
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3
CHROME CHAMBER =<250 MICRONS PIR6
PUMP2 STAGE 1 P2ST1
B3 424
I:022 15
I:024 07
[440]
DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE PS3
CRYO 2 TEMPERATUR =>290K CY2TMP290
DOOR 4 OPEN DROP4S
MANUAL CRYO GATE 2 OPEN MCG2OP
N7:25 6
I:002 05
B3 514
I:006 07
[459]
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2
CRYO 2 TEMPERATUR =>290K CY2TMP290
DOOR 2 OPEN DROP2S
DOOR 3 OPEN DROP3S
I:002 04
B3 514
I:006 03
I:006 05
VENT AREA 2 ENABLE
SYSTEM VENT ENABLE
COMPRESSOR 2 REGEN- ERATION PROGRAM
FIRST SCAN AFTER POWER LOSS
CRYO GATE SOLENOID 1 HEATER 2 CHAMBER

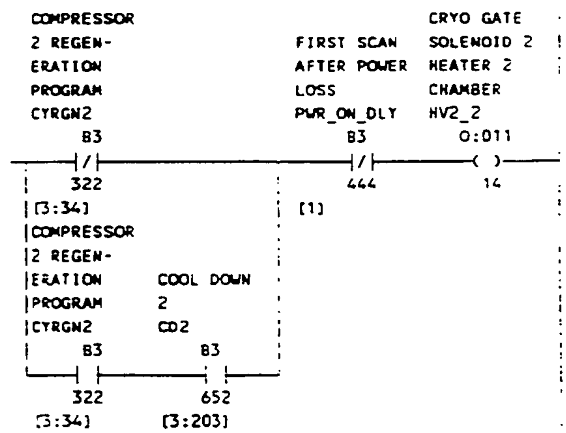



```
O:011/13 - ┤ ├ - File #5 FAULTS -  71
                 File #6 TECH_RUNGS -  6
           ┤/├ - File #5 FAULTS -  94,119
           -( )- - File #2 MAIN_PRGRM -  117
```

Rung #118

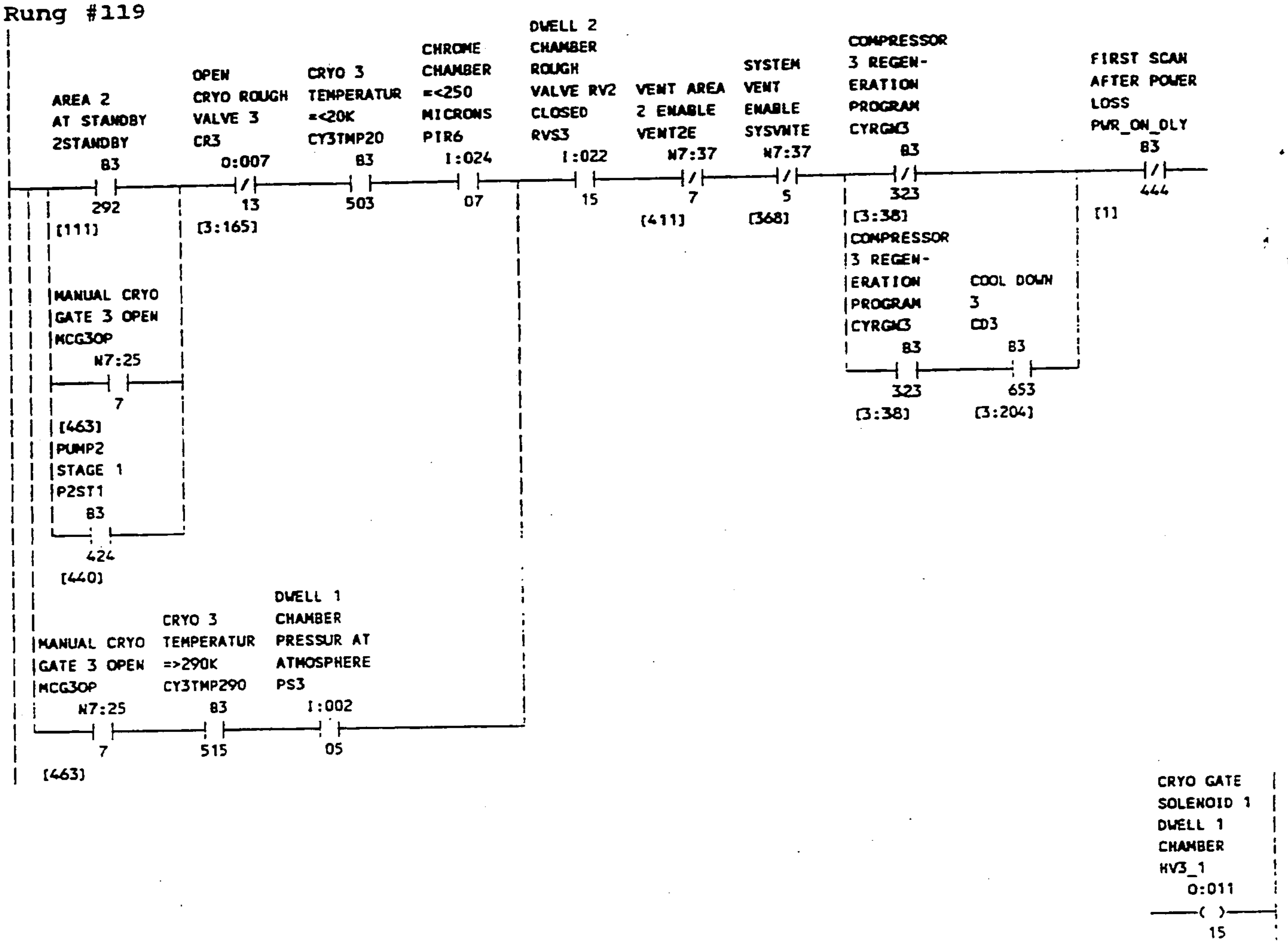

AREA 1 AT STANDBY 1STANDBY B3 291 [110]
AREA 2 AT STANDBY 2STANDBY B3 292 [111]
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
DOOR 3 OPEN DROP3S I:006 05
OPEN CRYO ROUGH VALVE 2 CR2 O:007 12 [3:164]
CRYO 2 TEMPERATUR =<20K CY2TMP20 B3 502
VENT AREA 1 ENABLE VENT1E N7:37 6 [405]
VENT AREA 2 ENABLE VENT2E N7:37 7 [411]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07
DOOR 4 OPEN DROP4S I:006 07
AUTO MODE ENABLE AUTO N7:37 11 [155]
PREPARE FOR AUTO RUN >AUTO N7:37 1 [157]
MANUAL CRYO GATE 2 OPEN MCG2OP N7:25 6 [459]
MANUAL CRYO GATE 2 THROTTLE MCG2TL N7:26 1 [461]
PUMP 1 STAGE 1 P1ST1 B3 422 [436]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
PUMP2 STAGE 1 P2ST1 B3 424 [440]
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07





O:011/14 - ┤ ├ - File #5 FAULTS - 71,94
File #6 TECH_RUNGS - 6
┤/├ - File #5 FAULTS - 119
-( )- - File #2 MAIN_PRGRM - 118

Rung #119




```
O:011/15 - -| |- - File #5 FAULTS -  73
                   File #6 TECH_RUNGS -  6
           -|/|- - File #5 FAULTS -  96,121
           -( )- - File #2 MAIN_PRGRM -  119
```

Rung #120

AREA 2
AT STANDBY
2STANDBY
B3
292
[111]

OPEN
CRYO ROUGH
VALVE 3
CR3
0:007
13
[3:165]

CRYO 3
TEMPERATUR
=<20K
CY3TMP20
B3
503

CHROME
CHAMBER
=<250
MICRONS
PIR6
I:024
07

DWELL 2
CHAMBER
ROUGH
VALVE RV2
CLOSED
RVS3
I:022
15

VENT AREA
2 ENABLE
VENT2E
N7:37
7
[411]

SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]

COMPRESSOR
3 REGEN-
ERATION
PROGRAM
CYRGN3
B3
323
[3:38]

FIRST SCAN
AFTER POWER
LOSS
PWR_ON_DLY
B3
444
[1]

COOL DOWN
3
CD3
B3
653
[3:204]

COMPRESSOR
3 REGEN-
ERATION
PROGRAM
CYRGN3
B3
323
[3:38]

MANUAL CRYO
GATE 3 OPEN
MCG3OP
N7:25
7
[463]

MANUAL CRYO
GATE 3
THROTTLE
MCG3TL
N7:26
2
[465]

PUMP2
STAGE 1
P2ST1
B3
424
[440]

MANUAL
CONTROL
CRYO GATE
3 THROTTLE
M-HV3-2
N7:5
2
[3]

PREPARE FOR
AUTO RUN
>AUTO
N7:37
1
[157]

AUTO
MODE
ENABLE
AUTO
N7:37
11
[155]

MANUAL CRYO
GATE 3 OPEN

CRYO 3
TEMPERATUR
=>290K

DWELL 1
CHAMBER
PRESSUR AT
ATMOSPHERE

> > >

```
 MCG3OP            CY3TMP290   PS3
   N7:25             B3        I:002
---] [----+--------] [--------] [---------------------------------------------------
     7    |         515         05
 [463]    |
 MANUAL CRYO
 GATE 3
 THROTTLE
 MCG3TL
   N7:26  |
---] [----+
     2
 [465]
                                                                       CRYO GATE
                                                                       SOLENOID 2
                                                                       DWELL 1
                                                                       CHAMBER
                                                                       HV3_2
                                                                         O:011
                                                                     ----( )----
                                                                          16

O:011/16 - ] [ - File #5 FAULTS -  73,96
                 File #6 TECH_RUNGS -  6
           ]/[ - File #5 FAULTS -  121
           -( )- - File #2 MAIN_PRGRM -  120
```

Rung #121

```
                                                  DWELL 2
                                          CHROME  CHAMBER                        COMPRESSOR
               OPEN          CRYO 4       CHAMBER ROUGH                  SYSTEM  5 REGEN-                      FIRST SCAN
 AREA 2        CRYO ROUGH    TEMPERATUR   =<250   VALVE RV2  VENT AREA   VENT    ERATION                       AFTER POWER
 AT STANDBY    VALVE 4       =<20K        MICRONS CLOSED     2 ENABLE    ENABLE  PROGRAM                       LOSS
 2STANDBY      CR4           CY4TMP20     PIR6    RVS3       VENT2E      SYSVNTE CYRGN5                        PWR_ON_DLY
    B3         O:027          B3          I:024   I:022      N7:37       N7:37    B3                            B3
---] [----+----]/[---------] [--------] [----+---] [--------]/[--------]/[----+--]/[-------------------+------]/[----
   292    |     11          504         07   |    15         7           5    |  325                  |       444
 [111]    |  [3:167]                         |             [411]       [368]  | [3:46]                | [1]
          |                                  |                                | COMPRESSOR            |
 PUMP2    |                                  |                                | 5 REGEN-              |
 STAGE 1  |                                  |                                | ERATION      COOL DOWN|
 P2ST1    |                                  |                                | PROGRAM      5        |
   B3     |                                  |                                | CYRGN5       CD5      |
---] [----+                                  |                                |   B3          B3      |
   424    |                                  |                                +--] [---------] [------+
 [440]    |                                  |                                   325          655
 MANUAL CRYO                                 |                                 [3:46]       [3:206]
 GATE 4 OPEN                                 |
 MCG4OP   |                                  |
   N7:25  |                                  |
---] [----+                                  |
     8                                       |
 [467]                                       |
                                DWELL 1      |
                 CRYO 4         CHAMBER      |
 MANUAL CRYO     TEMPERATUR     PRESSUR AT   |
 GATE 4 OPEN     =>290K         ATMOSPHERE   |
 MCG4OP          CY4TMP290      PS3          |
   N7:25           B3           I:002        |
---] [-----------] [----------] [------------+
     8            516           05
 [467]
                                                                                                          CRYO GATE
```

```
                                                              SOLENOID 1 |
                                                              DWELL 2    |
                                                              CHAMBER    |
                                                              HV4_1      |
                                                                0:031    |
                                                              ----( )----|
                                                                 11      |

0:031/11 - -| |- - File #5 FAULTS - 75
                   File #6 TECH_RUNGS - 6
           -|/|- - File #5 FAULTS - 98,123
           -( )- - File #2 MAIN_PRGRM - 121
```

Rung #122

AREA 2
AT STANDBY
2STANDBY
B3
292
[111]

OPEN
CRYO ROUGH
VALVE 4
CR4
O:027
11
[3:167]

CRYO 4
TEMPERATUR
=<20K
CY4TMP20
B3
504

CHROME
CHAMBER
=<250
MICRONS
PIR6
I:024
07

VENT AREA
2 ENABLE
VENT2E
N7:37
7
[411]

SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]

COMPRESSOR
5 REGEN-
ERATION
PROGRAM
CYRGN5
B3
325
[3:46]

FIRST SCAN
AFTER POWER
LOSS
PWR_ON_DLY
B3
444
[1]

SOLENOID 2
DWELL 2
CHAMBER
HV4_2
O:031
12

COMPRESSOR
5 REGEN-
ERATION
PROGRAM
CYRGN5
B3
325
[3:46]

COOL DOWN
5
CD5
B3
655
[3:206]

PUMP2
STAGE 1
P2ST1
B3
424
[440]

MANUAL CRYO
GATE 4 OPEN
MCG4OP
N7:25
8
[467]

MANUAL CRYO
GATE 4
THROTTLE
MCG4TL
N7:26
3
[469]

PREPARE FOR
AUTO RUN
>AUTO
N7:37
:
[157]

AUTO
MODE
ENABLE
AUTO
N7:37
11
[155]

MANUAL CRYO
GATE 4 OPEN
MCG4OP
N7:25
8
[467]

CRYO 4
TEMPERATUR
=>290K
CY4TMP290
B3
516

DWELL 1
CHAMBER
PRESSUR AT
ATMOSPHERE
PS3
I:002
05

MANUAL CRYO
GATE 4
THROTTLE
MCG4TL
N7:26

\>>>>>>> >>>>>>>

```
<   <<<<<<< <<<<<<<
         3
   [469]
0:031/12 - -| |- - File #5 FAULTS -  75,98
                    File #6 TECH_RUNGS -  6
           -|/|- - File #5 FAULTS -  123
           -( )- - File #2 MAIN_PRGRM -  122
```

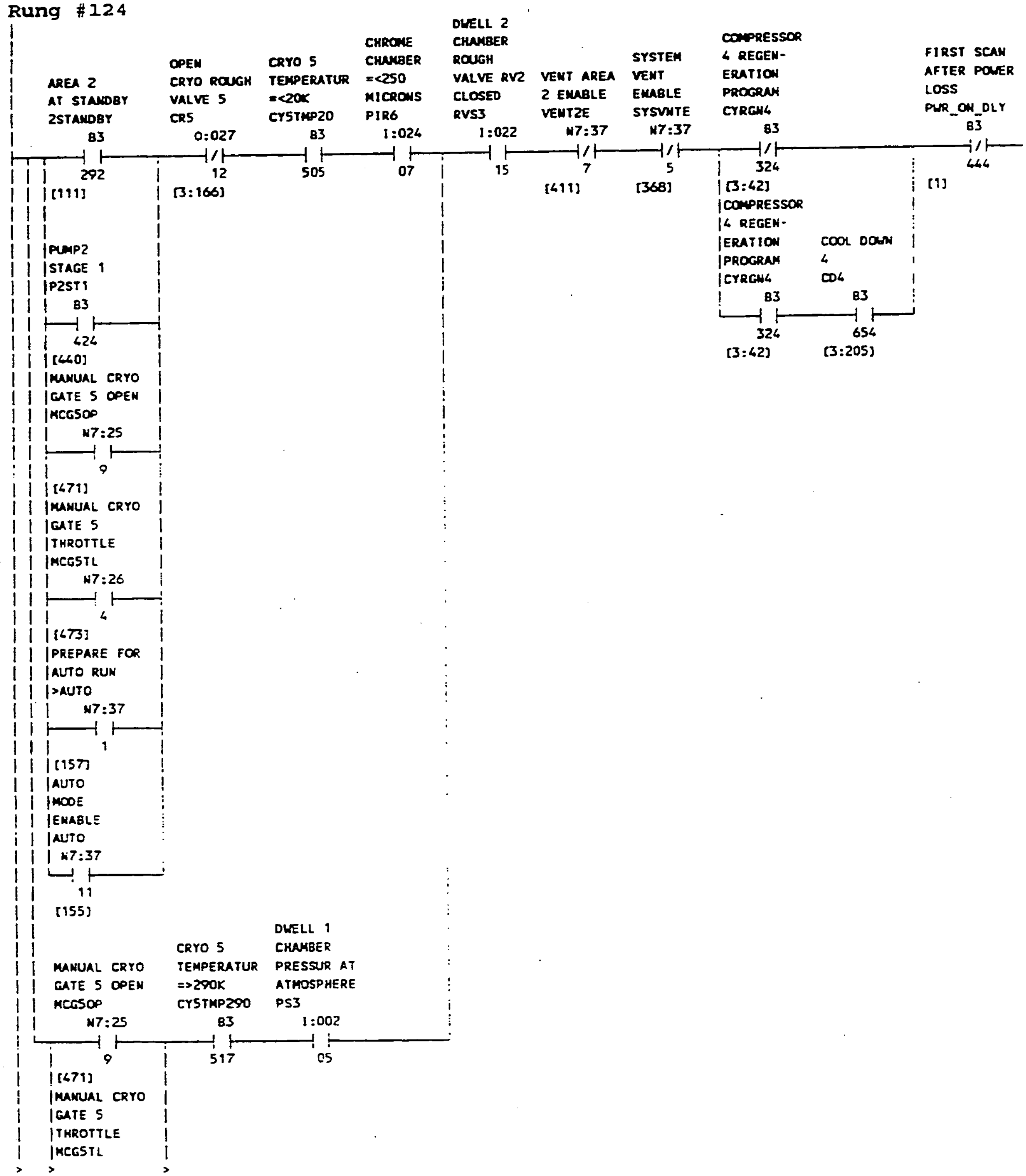
Rung #123

```
                                                    DWELL 2
                                          CHROME    CHAMBER                              COMPRESSOR
                     OPEN       CRYO 5    CHAMBER   ROUGH                      SYSTEM    4 REGEN-                         FIRST SCAN
   AREA 2            CRYO ROUGH TEMPERATUR =<250    VALVE RV2  VENT AREA       VENT      ERATION                          AFTER POWER
   AT STANDBY        VALVE 5    =<20K     MICRONS   CLOSED     2 ENABLE        ENABLE    PROGRAM                          LOSS
   2STANDBY          CR5        CY5TMP20  PIR6      RVS3       VENT2E          SYSVNTE   CYRGN4                           PWR_ON_DLY
      B3             0:027      B3        I:024     I:022      N7:37           N7:37     B3                               B3
  --| |--------------|/|--------| |-------| |-------| |---------|/|-------------|/|-------|/|------------------------------|/|--
      292            12         505       07        15         7               5         324                              444
   [111]             [3:166]                                   [411]           [368]     [3:42]                           [1]
                                                                                         COMPRESSOR
   PUMP2                                                                                 4 REGEN-
   STAGE 1                                                                               ERATION        COOL DOWN
   P2ST1                                                                                 PROGRAM        4
      B3                                                                                 CYRGN4         CD4
  --| |--                                                                                   B3            B3
      424                                                                               --| |-----------| |--
   [440]                                                                                    324           654
   MANUAL CRYO                                                                           [3:42]        [3:205]
   GATE 5 OPEN
   MCG5OP
      N7:25
  --| |--
      9
   [471]
                                DWELL 1
                     CRYO 5     CHAMBER
   MANUAL CRYO       TEMPERATUR PRESSUR AT
   GATE 5 OPEN       =>290K     ATMOSPHERE
   MCG5OP            CY5TMP290  PS3
      N7:25          B3         I:002
  --| |--------------| |--------| |--
      9              517        05
   [471]

                                                                                                                          CRYO GATE
                                                                                                                          SOLENOID 1
                                                                                                                          HEATER 2
                                                                                                                          CHAMBER
                                                                                                                          HV5_1
                                                                                                                            O:031
                                                                                                                          --( )--
                                                                                                                            13

0:031/13 - -| |- - File #5 FAULTS -  77
                    File #6 TECH_RUNGS -  6
           -|/|- - File #5 FAULTS -  100,125
           -( )- - File #2 MAIN_PRGRM -  123
```

Rung #124


AREA 2
AT STANDBY
2STANDBY
B3
292
[111]
OPEN
CRYO ROUGH
VALVE 5
CR5
O:027
12
[3:166]
CRYO 5
TEMPERATUR
=<20K
CYSTMP20
B3
505
CHROME
CHAMBER
=<250
MICRONS
PIR6
I:024
07
DWELL 2
CHAMBER
ROUGH
VALVE RV2
CLOSED
RVS3
I:022
15
VENT AREA
2 ENABLE
VENT2E
N7:37
7
[411]
SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]
COMPRESSOR
4 REGEN-
ERATION
PROGRAM
CYRGN4
B3
324
[3:42]
FIRST SCAN
AFTER POWER
LOSS
PWR_ON_DLY
B3
444
[1]
COMPRESSOR
4 REGEN-
ERATION
PROGRAM
CYRGN4
B3
324
[3:42]
COOL DOWN
4
CD4
B3
654
[3:205]
PUMP2
STAGE 1
P2ST1
B3
424
[440]
MANUAL CRYO
GATE 5 OPEN
MCG5OP
N7:25
9
[471]
MANUAL CRYO
GATE 5
THROTTLE
MCG5TL
N7:26
4
[473]
PREPARE FOR
AUTO RUN
>AUTO
N7:37
1
[157]
AUTO
MODE
ENABLE
AUTO
N7:37
11
[155]
MANUAL CRYO
GATE 5 OPEN
MCG5OP
N7:25
9
[471]
CRYO 5
TEMPERATUR
=>290K
CYSTMP290
B3
517
DWELL 1
CHAMBER
PRESSUR AT
ATMOSPHERE
PS3
I:002
05
MANUAL CRYO
GATE 5
THROTTLE
MCG5TL

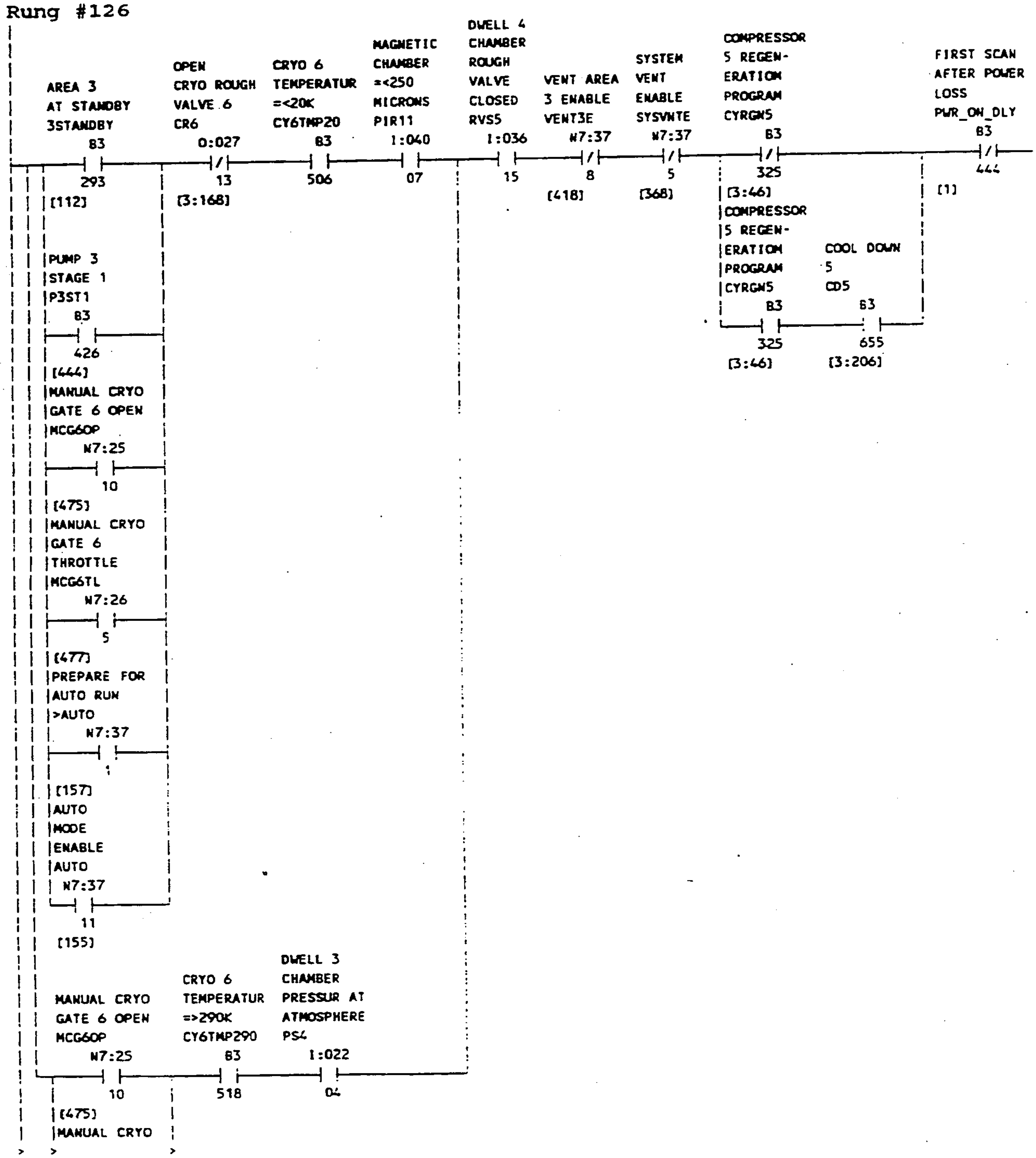
```
 <  <              <
 |  |   N7:26      |
 |  └────┤ ├───────┘
 |        4
 |  [473]
                                                                                     CRYO GATE    |
                                                                                     SOLENOID 2   |
                                                                                     HEATER 2     |
                                                                                     CHAMBER      |
                                                                                     HVS_2        |
                                                                                       O:031      |
                                                                                     ────( )──────|
                                                                                         14       |

0:031/14 - ┤ ├ - File #5 FAULTS -  77,100
                 File #6 TECH_RUNGS -  6
         ┤/├ - File #5 FAULTS -  125
         -( )- - File #2 MAIN_PRGRM -  124
Rung #125
|
|                                              DWELL 4
|                                    MAGNETIC  CHAMBER                      COMPRESSOR
|            OPEN        CRYO 6      CHAMBER   ROUGH                SYSTEM  5 REGEN-                    FIRST SCAN
|  AREA 3    CRYO ROUGH  TEMPERATUR  =<250     VALVE    VENT AREA   VENT    ERATION                     AFTER POWER
|  AT STANDBY VALVE 6    =<20K       MICRONS   CLOSED   3 ENABLE    ENABLE  PROGRAM                     LOSS
|  3STANDBY  CR6         CY6TMP20    PIR11     RVS5     VENT3E      SYSVNTE CYRGN5                      PWR_ON_DLY
|     B3       O:027       B3        I:040     I:036     N7:37      N7:37     B3                           B3
|─┬─┬──┤ ├──────┤/├────────┤ ├────────┤ ├───────┤ ├──────┤/├────────┤/├──┬───┤/├──────────────────┬──────┤/├──
| | |    293      13        506        07        15        8          5   |   325                  |      444
| | |[112]    [3:168]                                   [418]      [368]  |[3:46]                  |  [1]
| | |                                                                     |COMPRESSOR              |
| | |                                                                     |5 REGEN-                |
| | |PUMP 3                                                               |ERATION     COOL DOWN   |
| | |STAGE 1                                                              |PROGRAM     5           |
| | |P3ST1                                                                |CYRGN5      CD5         |
| | |  B3                                                                 |   B3         B3        |
| | |──┤ ├───┤                                                            └───┤ ├────────┤ ├───────┘
| | |  426                                                                    325          655
| | |[444]                                                                 [3:46]       [3:206]
| | |MANUAL CRYO
| | |GATE 6 OPEN
| | |MCG6OP
| | |   N7:25
| | └────┤ ├───┤
| |        10
| | [475]
| |                          DWELL 3
| |             CRYO 6       CHAMBER
| |MANUAL CRYO  TEMPERATUR   PRESSUR AT
| |GATE 6 OPEN  =>290K       ATMOSPHERE
| |MCG6OP       CY6TMP290    PS4
| |  N7:25         B3         I:022
| └────┤ ├─────────┤ ├────────┤ ├──────────┘
|        10        518         04
|  [475]
                                                                                     CRYO GATE
                                                                                     SOLENOID 1
                                                                                     DWELL 3
                                                                                     CHAMBER
                                                                                     HV6_1
                                                                                       O:031
                                                                                     ────( )──────
                                                                                         15

0:031/15 - ┤ ├ - File #5 FAULTS -  79
```

File #6 TECH_RUNG 6
—|/|— - File #5 FAULTS - 127
—( )— - File #2 MAIN_PRGRM - 125

Rung #126



```
|GATE 6
|THROTTLE
|MCG6TL
|  N7:26
|---] [---
     5
[477]

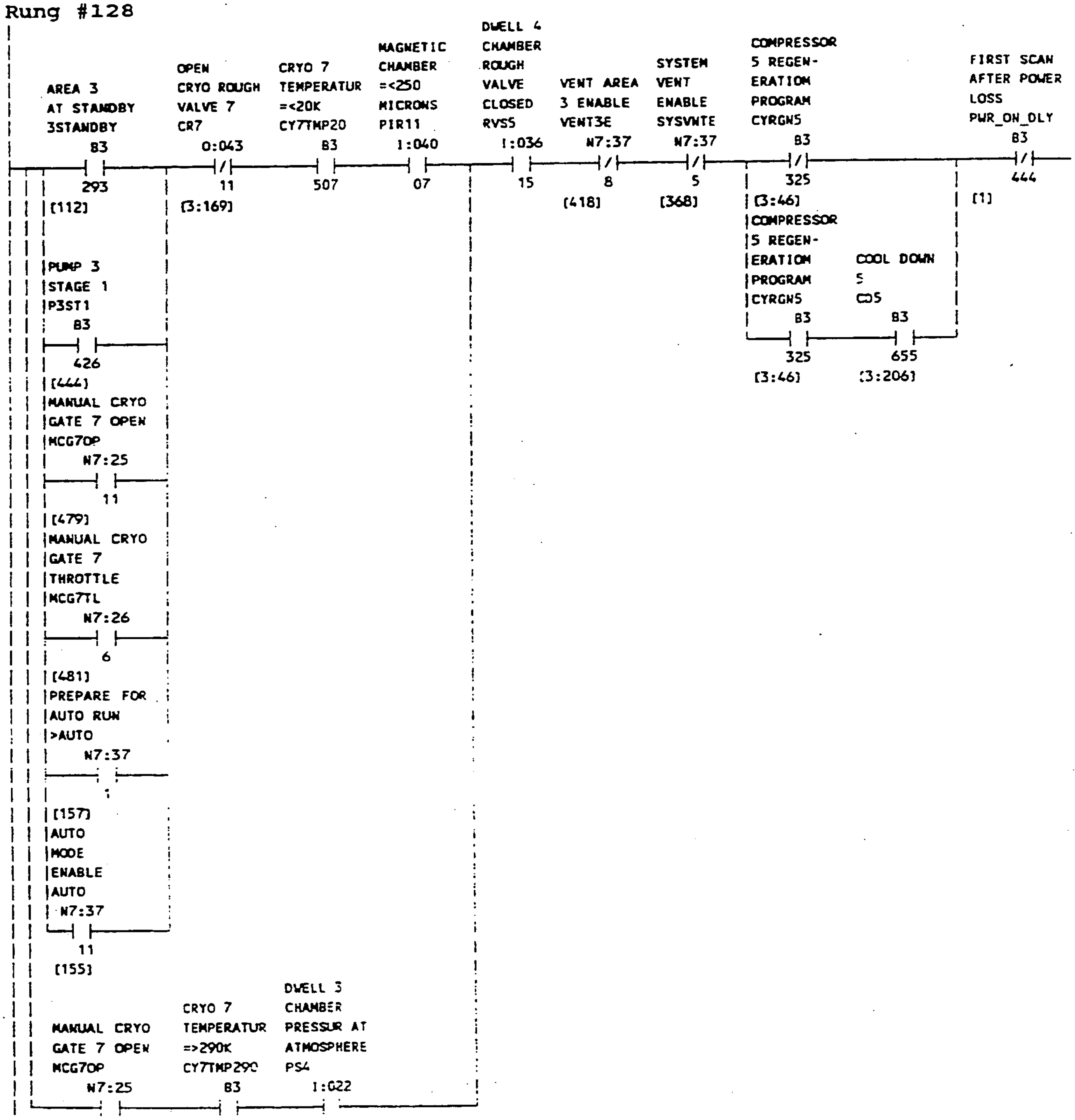
                                                        CRYO GATE
                                                        SOLENOID 2
                                                        DWELL 3
                                                        CHAMBER
                                                        HV6_2
                                                          O:031
                                                        ---( )---
                                                           16

O:031/16 - ] [ - File #5 FAULTS -  79,102
                 File #6 TECH_RUNGS -  6
           ]/[ - File #5 FAULTS -  127
           -( )- - File #2 MAIN_PRGRM -  126
Rung #127
                                            DWELL 4
                                 MAGNETIC   CHAMBER                        COMPRESSOR
             OPEN       CRYO 7   CHAMBER    ROUGH                 SYSTEM   5 REGEN-               FIRST SCAN
AREA 3       CRYO ROUGH TEMPERATUR =<250    VALVE    VENT AREA    VENT     ERATION                AFTER POWER
AT STANDBY   VALVE 7    =<20K    MICRONS    CLOSED   3 ENABLE     ENABLE   PROGRAM                LOSS
3STANDBY     CR7        CY7TMP20 PIR11      RVS5     VENT3E       SYSVNTE  CYRGN5                 PWR_ON_DLY
   B3        O:043      B3       I:040      I:036    N7:37        N7:37    B3                     B3
---] [-------]/[--------] [------] [--------] [--------]/[--------]/[-------]/[-------------------]/[---
   293        11        507      07         15       8            5        325                    444
[112]        [3:169]                                 [418]        [368]    [3:46]                 [1]
                                                                           COMPRESSOR
|PUMP 3                                                                    5 REGEN-
|STAGE 1                                                                   ERATION    COOL DOWN
|P3ST1                                                                     PROGRAM    5
|  B3                                                                      CYRGN5     CD5
|---] [---                                                                   B3         B3
   426                                                                     ---] [--------] [---
[444]                                                                        325        655
|MANUAL CRYO                                                               [3:46]     [3:206]
|GATE 7 OPEN
|MCG7OP
|  N7:25
|---] [---
     11
[479]
                             DWELL 3
               CRYO 7        CHAMBER
|MANUAL CRYO   TEMPERATUR    PRESSUR AT
|GATE 7 OPEN   =>290K        ATMOSPHERE
|MCG7OP        CY7TMP290     PS4
|  N7:25         B3          I:022
|---] [----------] [----------] [---
     11          519          04
[479]

                                                        CRYO GATE
                                                        SOLENOID 1
                                                        DWELL 4
                                                        CHAMBER
                                                        HV7_1
                                                          O:045
                                                        ---( )---
```

O:045/11 - ┤ ├ - File #5 FAULTS - 81
File #6 TECH_RUNGS - 6
┤/├ - File #5 FAULTS - 104,129
–( )– - File #2 MAIN_PRGRM - 127

Rung #128



11 519
[479]
MANUAL CRYO
GATE 7
THROTTLE
MCG7TL
N7:26
6
[481]

CRYO GATE
SOLENOID 2
DWELL 4
CHAMBER
HV7_2
O:045
12

O:045/12 -] [- File #5 FAULTS - 81,104
File #6 TECH_RUNGS - 7
]/[- File #5 FAULTS - 129
-( )- - File #2 MAIN_PRGRM - 128

Rung #129

AREA 3 AT STANDBY 3STANDBY B3 293 [112]
OPEN CRYO ROUGH VALVE 8 CR8 O:043 12 [3:170]
CRYO 8 TEMPERATUR =<20K CY8TMP20 B3 508
MAGNETIC CHAMBER =<250 MICRONS PIR11 I:040 07
DWELL 4 CHAMBER ROUGH VALVE CLOSED RVS5 I:036 15
VENT AREA 3 ENABLE VENT3E N7:37 8 [418]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6 B3 326 [3:52]
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 444

PUMP 3 STAGE 1 P3ST1 B3 426 [444]
MANUAL CRYO GATE 8 OPEN MCG8OP N7:25 12 [483]

COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6 B3 326 [3:52]
COOL DOWN 6 CD6 B3 656 [3:207]

MANUAL CRYO GATE 8 OPEN MCG8OP N7:25 12 [483]
CRYO 8 TEMPERATUR =>290K CY8TMP290 B3 520
DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE PS4 I:022 04

CRYO GATE
SOLENOID 1
BUFFER 3
CHAMBER

```
                                                                                   HV8_1
                                                                                   O:045
                                                                               ----( )----
                                                                                    13

O:045/13 - -| |- - File #5 FAULTS -  83
                   File #6 TECH_RUNGS -  7
           -|/|- - File #5 FAULTS -  106,131
           -( )- - File #2 MAIN_PRGRM -  129
Rung #130

                                              DWELL 4                      COMPRESSOR
                                  MAGNETIC    CHAMBER              SYSTEM  6 REGEN-                 FIRST SCAN
             OPEN       CRYO 8    CHAMBER     ROUGH                VENT    ERATION                  AFTER POWER
AREA 3       CRYO ROUGH TEMPERATUR =<250      VALVE     VENT AREA  ENABLE  PROGRAM                  LOSS
AT STANDBY   VALVE 8    =<20K     MICRONS     CLOSED    3 ENABLE   SYSVNTE CYRGN6                   PWR_ON_DLY
3STANDBY     CR8        CY8TMP20  PIR11       RVS5      VENT3E     N7:37   B3                       B3
   B3        O:043      B3        I:040       I:036     N7:37      -|/|-   -|/|-                    -|/|-
  -| |-      -|/|-      -| |-     -| |-       -| |-     -|/|-      5       326                      444
   293        12        508        07          15        8        [368]   [3:52]                    [1]
[112]        [3:170]                                    [418]             COMPRESSOR
                                                                          6 REGEN-
PUMP 3                                                                    ERATION     COOL DOWN
STAGE 1                                                                   PROGRAM     6
P3ST1                                                                     CYRGN6      CD6
   B3                                                                       B3          B3
  -| |-                                                                    -| |-       -| |-
   426                                                                      326         656
[444]                                                                     [3:52]      [3:207]
MANUAL CRYO
GATE 8 OPEN
MCG8OP
   N7:25
  -| |-
   12
[483]
MANUAL CRYO
GATE 8
THROTTLE
MCG8TL
   N7:26
  -| |-
   7
[485]
PREPARE FOR
AUTO RUN
>AUTO
   N7:37
  -| |-
   1
[157]
AUTO
MODE
ENABLE
AUTO
   N7:37
  -| |-
   11
[155]
                                     DWELL 3
                         CRYO 8      CHAMBER
MANUAL CRYO              TEMPERATUR  PRESSUR AT
GATE 8 OPEN              =>290K      ATMOSPHERE
>  >                                              >
```

```
 MCG8OP          CY8TMP290   PS4
   N7:25            B3       I:022
 --] [-----------] [--------] [------
    12             520        04
 [483]
 MANUAL CRYO
 GATE 8
 THROTTLE
 MCG8TL
   N7:26
 --] [--
    7
 [485]
                                                        CRYO GATE
                                                        SOLENOID 2
                                                        BUFFER 3
                                                        CHAMBER
                                                        MV8_2
                                                          O:045
                                                        ---( )---
                                                            14

O:045/14 - -] [- - File #5 FAULTS -  83,106
                   File #6 TECH_RUNGS -  7
           -]/[- - File #5 FAULTS -  131
           -( )- - File #2 MAIN_PRGRM -  130
```

Rung #131

```
                                          DWELL 5
                               CARBON     CHAMBER                          COMPRESSOR
              OPEN     CRYO 9  CHAMBER    ROUGH                 SYSTEM     7 REGEN-              FIRST SCAN
 AREA 4       CRYO ROUGH TEMPERATUR =<250 VALVE     VENT AREA   VENT       ERATION               AFTER POWER
 AT STANDBY   VALVE 9  =<20K   MICRONS    CLOSED    4 ENABLE    ENABLE     PROGRAM               LOSS
 4STANDBY     CR9      CY9TMP20 PIR16     RVS7      VENT4E      SYSVNTE    CYRGN7                PWR_ON_DLY
    B3        O:043      B3     I:054     I:052     N7:37       N7:37        B3                    B3
 --] [------]/[------] [------] [-------] [------]/[--------]/[---------]/[--------------------]/[---
    294        13       509      07        14        9           5          327                   444
 [113]      [3:171]                                [425]       [368]      [3:57]                 [1]
                                                                          COMPRESSOR
 PUMP 4                                                                   7 REGEN-
 STAGE 1                                                                  ERATION     COOL DOWN
 P4ST1                                                                    PROGRAM     7
   B3                                                                     CYRGN7      CD7
 --] [--                                                                    B3          B3
   428                                                                    --] [--------] [--
 [449]                                                                      327         657
 MANUAL CRYO                                                              [3:57]      [3:208]
 GATE 9 OPEN
 MCG9OP
   N7:25
 --] [--
    13
 [487]
                              DWELL 5
                 CRYO 9       CHAMBER
 MANUAL CRYO     TEMPERATUR   PRESSUR AT
 GATE 9 OPEN     =>290K       ATMOSPHERE
 MCG9OP          CY9TMP290    PS5
   N7:25            B3          I:036
 --] [-----------] [----------] [--
    13             521           04
 [487]
                                                                                         CRYO GATE
```

```
                                                         SOLENOID 1 |
                                                         DWELL 5    |
                                                         CHAMBER    |
                                                         HV9_1      |
                                                           O:045    |
                                                         ----( )----|
                                                            15      |

O:045/15 - -| |- - File #5 FAULTS -  85
                   File #6 TECH_RUNGS -  7
           -|/|- - File #5 FAULTS -  108,133
           -( )- - File #2 MAIN_PRGRM -  131
```

197

Rung #132

AREA 4 AT STANDBY 4STANDBY B3 294 [113]

OPEN CRYO ROUGH VALVE 9 CR9 O:043 13 [3:171]

CRYO 9 TEMPERATUR =<20K CY9TMP20 B3 509

CARBON CHAMBER =<250 MICRONS PIR16 I:054 07

DWELL 5 CHAMBER ROUGH VALVE CLOSED RVS7 I:052 14

VENT AREA 4 ENABLE VENT4E N7:37 9 [425]

SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]

COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 327 [3:57]

FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 444 [1]

COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 327 [3:57]

COOL DOWN 7 CD7 B3 657 [3:208]

PUMP 4 STAGE 1 P4ST1 B3 428 [449]

MANUAL CRYO GATE 9 OPEN MCG9OP N7:25 13 [487]

MANUAL CRYO GATE 9 THROTTLE MCG9TL N7:26 8 [489]

PREPARE FOR AUTO RUN >AUTO N7:37 1 [157]

AUTO MODE ENABLE AUTO N7:37 11 [155]

MANUAL CRYO GATE 9 OPEN MCG9OP N7:25 13 [487]

CRYO 9 TEMPERATUR =>290K CY9TMP290 B3 521

DWELL 5 CHAMBER PRESSUR AT ATMOSPHERE PS5 I:036 04

MANUAL CRYO GATE 9 THROTTLE MCG9TL

> > >

N7:26
8
[489]

CRYO GATE
SOLENOID 2
DWELL 5
CHAMBER
HV9_2
0:045
-( )-
16

0:045/16 - ┤ ├ - File #5 FAULTS - 85,108
File #6 TECH_RUNGS - 7
┤/├ - File #5 FAULTS - 133
-( )- - File #2 MAIN_PRGRM - 132

Rung #133

AREA 4 AT STANDBY 4STANDBY B3 294 [113]
OPEN CRYO ROUGH VALVE 10 CR10 0:057 11 [3:172]
CRYO 10 TEMPERATUR =<20K CY10TMP20 B3 510
CARBON CHAMBER =<250 MICRONS PIR16 I:054 07
DWELL 5 CHAMBER ROUGH VALVE CLOSED RVS7 I:052 14
VENT AREA 4 ENABLE VENT4E N7:37 9 [425]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 327 [3:57]
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 444 [1]

PUMP 4 STAGE 1 P4ST1 B3 428 [449]
MANUAL CRYO GATE 10 OPEN MCG100P N7:25 14 [491]

COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 327 [3:57]
COOL DOWN 7 CD7 B3 657 [3:208]

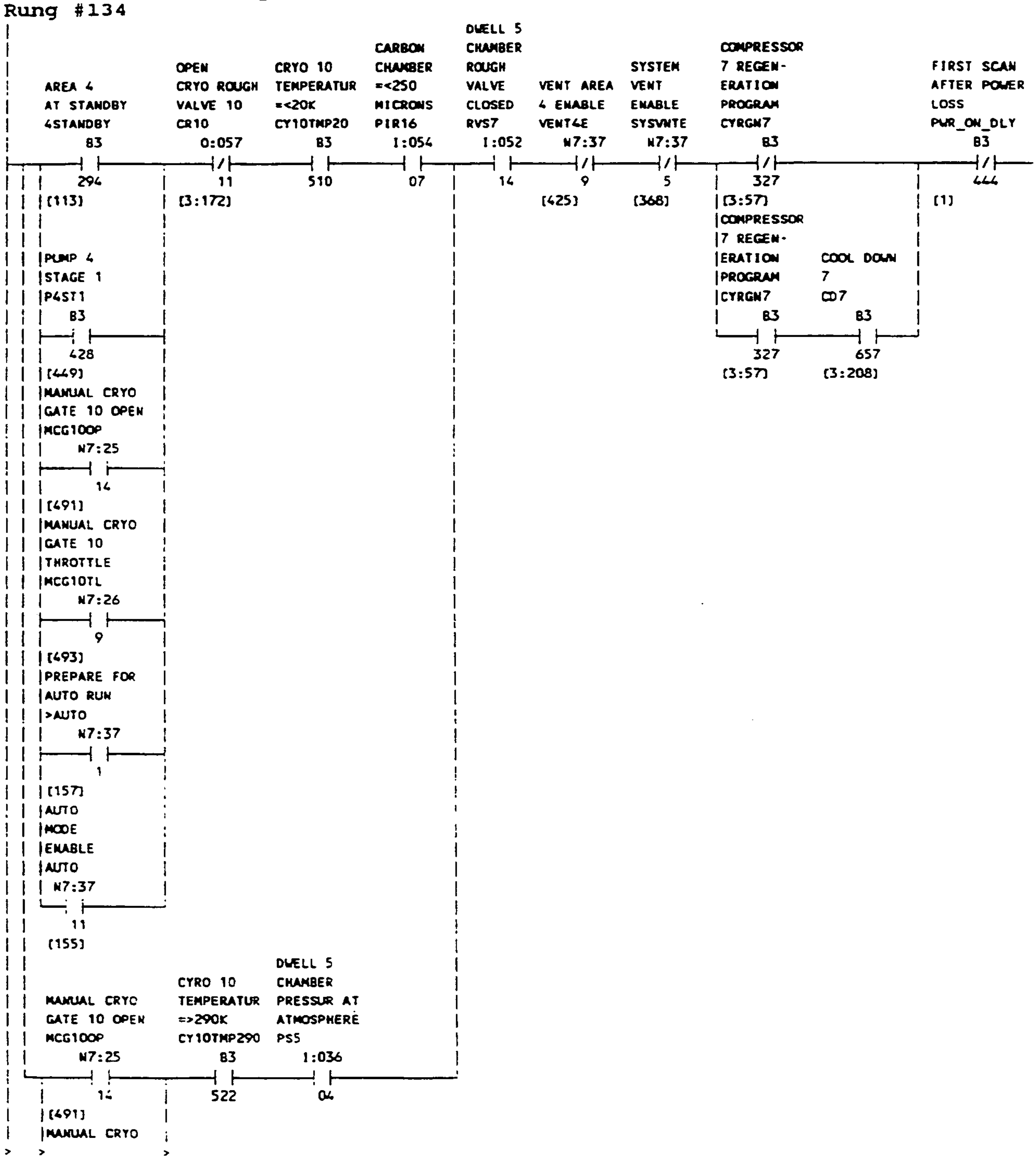
MANUAL CRYO GATE 10 OPEN MCG100P N7:25 14 [491]
CYRO 10 TEMPERATUR =>290K CY10TMP290 B3 522
DWELL 5 CHAMBER PRESSUR AT ATMOSPHERE PS5 I:036 04

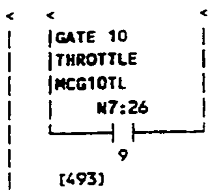
CRYO GATE
SOLENOID 1
DWELL 6
CHAMBER
HV10_1
0:061
-( )-
11

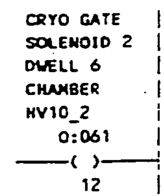
0:061/11 - ┤ ├ - File #5 FAULTS - 87,110

File #6 TECH_RUNG. 7
-|/|- - File #5 FAULTS - 135
-( )- - File #2 MAIN_PRGRM - 133

Rung #134

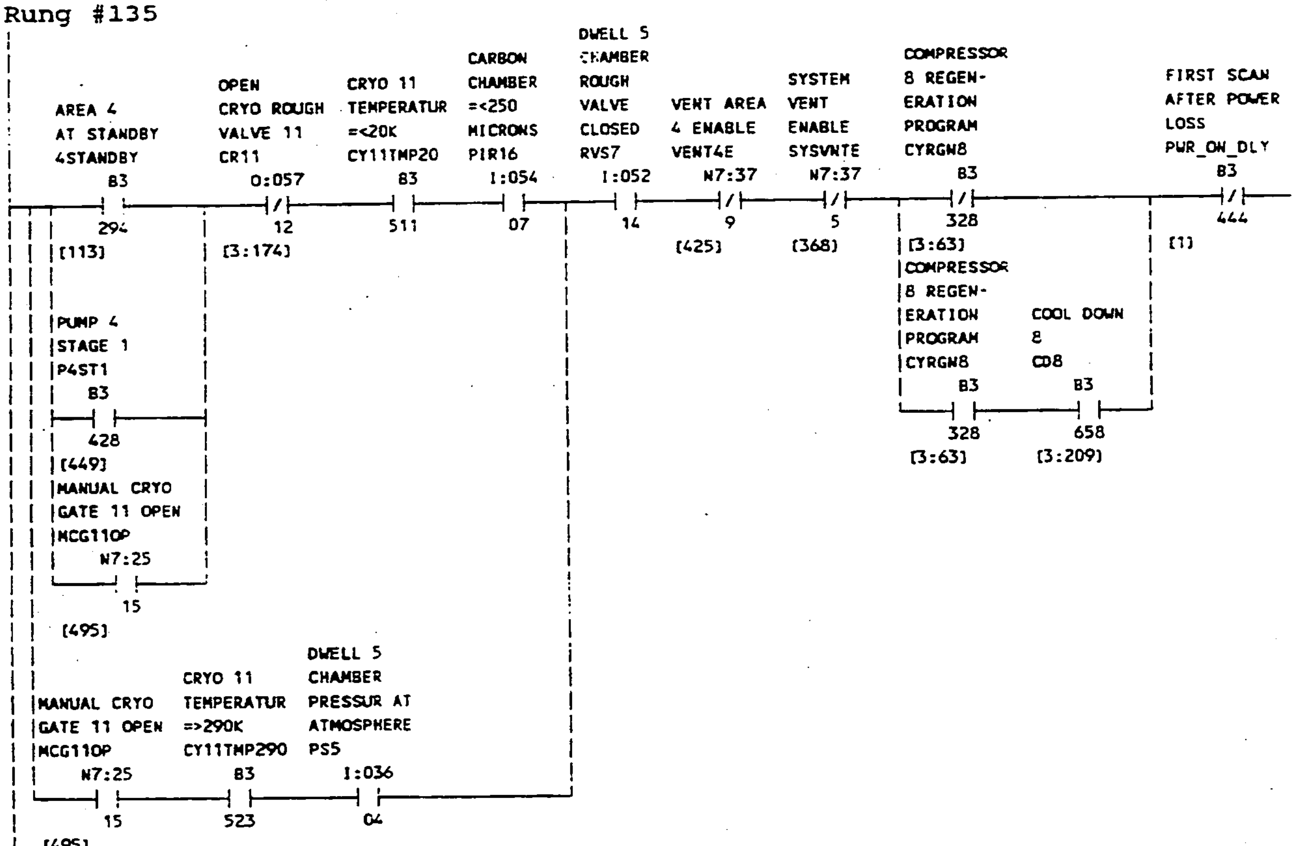


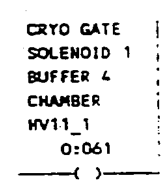




0:061/12 - ┤ ├ - File #5 FAULTS - 87
File #6 TECH_RUNGS - 7
┤/├ - File #5 FAULTS - 110,135
-( )- - File #2 MAIN_PRGRM - 134

Rung #135





```
0:061/13 - -| |- - File #5 FAULTS -  89
                   File #6 TECH_RUNGS -  7
          -|/|- - File #5 FAULTS -  112,137
          -( )- - File #2 MAIN_PRGRM -  135
Rung #136
|                                                            DWELL 5
|                                                 CARBON     CHAMBER                           COMPRESSOR
|                        OPEN         CRYO 11     CHAMBER    ROUGH                  SYSTEM     8 REGEN-                         FIRST SCAN
|  AREA 4                CRYO ROUGH   TEMPERATUR  =<250      VALVE      VENT AREA   VENT       ERATION                          AFTER POWER
|  AT STANDBY            VALVE 11     =<20K       MICRONS    CLOSED     4 ENABLE    ENABLE     PROGRAM                          LOSS
|  4STANDBY              CR11         CY11TMP20   PIR16      RVS7       VENT4E      SYSVNTE    CYRGN8                           PWR_ON_DLY
|     B3                   0:057         B3         I:054      I:052      N7:37       N7:37       B3                              B3
|-+-+-----| |------+--------|/|--------| |---------| |----+----| |--------|/|---------|/|---+-----|/|--------------+-------------|/|---
| | |    294       |         12        511         07    |    14          9           5     |     328               |            444
| | |[113]         |[3:174]                              |             [425]       [368]    |[3:63]                 |[1]
| | |              |                                     |                                  |COMPRESSOR             |
| | |              |                                     |                                  |8 REGEN-               |
| | |PUMP 4        |                                     |                                  |ERATION    COOL DOWN   |
| | |STAGE 1       |                                     |                                  |PROGRAM    8           |
| | |P4ST1         |                                     |                                  |CYRGN8     CD8         |
| | |  B3          |                                     |                                  |   B3         B3       |
| | |---| |--------|                                     |                                  +---| |--------| |------+
| | |  428         |                                     |                                     328        658
| | |[449]         |                                     |                                   [3:63]     [3:209]
| | |MANUAL CRYO   |                                     |
| | |GATE 11 OPEN  |                                     |
| | |MCG11OP       |                                     |
| | |   N7:25      |                                     |
| | |----| |-------|                                     |
| | |    15        |                                     |
| | |[495]         |                                     |
| | |MANUAL CRYO   |                                     |
| | |GATE 11       |                                     |
| | |THROTTLE      |                                     |
| | |MCG11TL       |                                     |
| | |   N7:26      |                                     |
| | |----| |-------|                                     |
| | |    10        |                                     |
| | |[497]         |                                     |
| | |PREPARE FOR   |                                     |
| | |AUTO RUN      |                                     |
| | |>AUTO         |                                     |
| | |   N7:37      |                                     |
| | |----| |-------|                                     |
| | |    1         |                                     |
| | |[157]         |                                     |
| | |AUTO          |                                     |
| | |MODE          |                                     |
| | |ENABLE        |                                     |
| | |AUTO          |                                     |
| | | N7:37        |                                     |
| | +--| |---------+                                     |
| |    11                                                |
| |  [155]                                               |
| |                                 DWELL 5              |
| |                   CRYO 11       CHAMBER              |
| |  MANUAL CRYO      TEMPERATUR    PRESSUR AT           |
| |  GATE 11 OPEN     =>290K        ATMOSPHERE           |
| |  MCG11OP          CY11TMP290    PS5                  |
| |     N7:25            B3           I:036              |
| +-----| |-------------| |-----------| |----------------+
>  >                 >
```

15 523 04
[495]
MANUAL CRYO
GATE 11
THROTTLE
MCG11TL
N7:26
10
[497]

CRYO GATE
SOLENOID 2
BUFFER 4
CHAMBER
HV11_2
0:061
( )
14

0:061/14 - ┤ ├ - File #5 FAULTS - 89,112
File #6 TECH_RUNGS - 7
┤/├ - File #5 FAULTS - 137
-( )- - File #2 MAIN_PRGRM - 136

Rung #137

AREA 5
AT STANDBY
5STANDBY
B3
295
[114]

OPEN
CRYO ROUGH
VALVE 12
CR12
0:057
13
[3:173]

CRYO 12
TEMPERATUR
=<20K
CY12TMP20
B3
512

EXIT BUFFER
CHAMBER
=<250
MICRONS
PIR15
I:040
13

EXLOCK
CHAMBER
ROUGH
VALVE
CLOSED
RVS9
I:052
16

VENT AREA
5 ENABLE
VENT5E
N7:37
10
[430]

SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]

COMPRESSOR
7 REGEN-
ERATION
PROGRAM
CYRGN7
B3
327
[3:57]

PUMP 5
STAGE 1
P5ST1
B3
430
[453]

DOOR 11
CLOSED
DRCL11S
I:056
04

COMPRESSOR
7 REGEN-
ERATION
PROGRAM
CYRGN7
B3
327
[3:57]

COOL DOWN
7
CD7
B3
657
[3:208]

MANUAL CRYO
GATE 12 OPEN
MCG12OP
N7:26
0
[499]

MANUAL CRYO
GATE 12 OPEN
MCG12OP
N7:26
0
[499]

CRYO 12
TEMPERATUR
=>290K
CY12TMP290
B3
524

EXLOCK
CHAMBER
PRESSUR AT
ATMOSPHERE
PS6
I:052
04

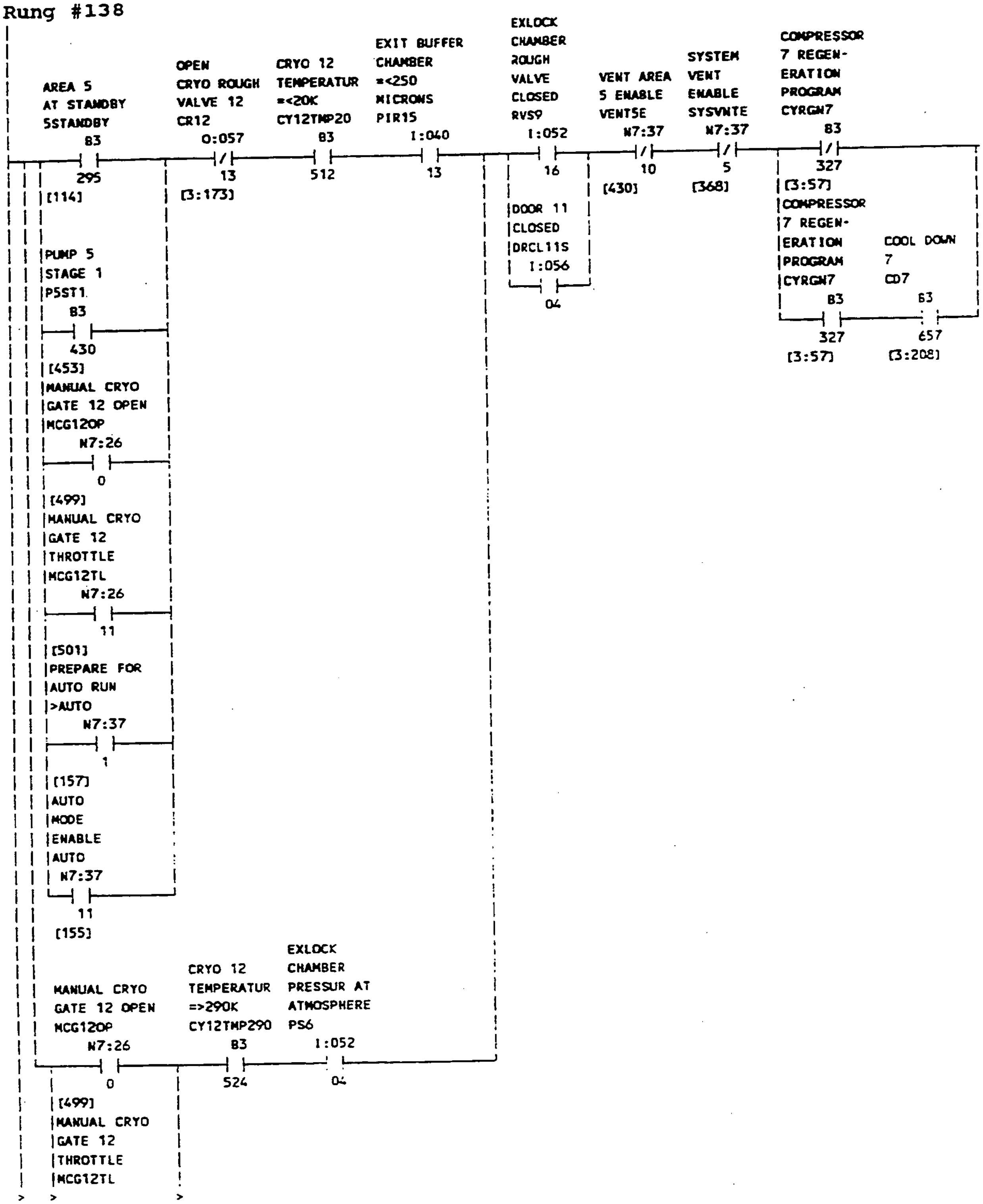
FIRST SCAN
AFTER POWER
LOSS

CRYO GATE
SOLENOID 1
EXBUFFER
CHAMBER

```
PWR_ON_DLY    HV12_1
    B3        O:061
---]/[---------( )---
   444          15
[1]
```

```
O:061/15 - ] [ - - File #5 FAULTS -  91
                   File #6 TECH_RUNGS -  7
           ]/[ - - File #5 FAULTS -  114,139
           ( ) - - File #2 MAIN_PRGRM -  137
```

Rung #138


AREA 5 AT STANDBY 5STANDBY
B3
295
[114]
OPEN CRYO ROUGH VALVE 12 CR12
O:057
13
[3:173]
CRYO 12 TEMPERATUR =<20K CY12TMP20
B3
512
EXIT BUFFER CHAMBER =<250 MICRONS PIR15
I:040
13
EXLOCK CHAMBER ROUGH VALVE CLOSED RVS9
I:052
16
VENT AREA 5 ENABLE VENT5E
N7:37
10
[430]
SYSTEM VENT ENABLE SYSVNTE
N7:37
5
[368]
COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7
B3
327
[3:57]
DOOR 11 CLOSED DRCL11S
I:056
04
COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7
B3
327
[3:57]
COOL DOWN 7 CD7
B3
657
[3:208]
PUMP 5 STAGE 1 P5ST1
B3
430
[453]
MANUAL CRYO GATE 12 OPEN MCG12OP
N7:26
0
[499]
MANUAL CRYO GATE 12 THROTTLE MCG12TL
N7:26
11
[501]
PREPARE FOR AUTO RUN >AUTO
N7:37
1
[157]
AUTO MODE ENABLE AUTO
N7:37
11
[155]
MANUAL CRYO GATE 12 OPEN MCG12OP
N7:26
0
CRYO 12 TEMPERATUR =>290K CY12TMP290
B3
524
EXLOCK CHAMBER PRESSUR AT ATMOSPHERE PS6
I:052
04
[499]
MANUAL CRYO GATE 12 THROTTLE MCG12TL

```
< <                 <
| |      N7:26      |
| └──────┤ ├────────┘
|          11
|  [501]
                                                              CRYO GATE     |
                                               FIRST SCAN     SOLENOID 2    |
                                               AFTER POWER    EXBUFFER      |
                                               LOSS           CHAMBER       |
                                               PWR_ON_DLY     HV12_2        |
                                                  B3             O:061      |
                                               ──┤/├──────────────( )───────|
                                                  444             16
                                               [1]

O:061/16 - ┤ ├ - File #5 FAULTS -  91,114
                 File #6 TECH_RUNGS -  7
           ┤/├ - File #5 FAULTS -  139
           -( )- - File #2 MAIN_PRGRM -  138
```

Rung #139

```
|                                                              EXITLOCK      |
|DOOR 10                                                       HIVAC BAFFLE  |
|CLOSED                                                        ENABLE        |
|DRCL10S                                                       HV12_3        |
| I:056                                                          O:061       |
├──┤ ├─────────────────────────────────────────────────────────────(U)──────┤
   02                                                              17        |
O:061/17 - -(L)- - File #2 MAIN_PRGRM -  324
           -(U)- - File #2 MAIN_PRGRM -  139
```

Rung #140

```
|          HEATER 1  CHROME    MAGNETIC  CARBON    EXIT BUFFER
|PUMPDOWN  CHAMBER   CHAMBER   CHAMBER   CHAMBER   CHAMBER                SYSTEM IS
|SYSTEM    =<250     =<250     =<250     =<250     =<250                  PUMPED
|ENABLE    MICRONS   MICRONS   MICRONS   MICRONS   MICRONS                DOWN
|PDSE      PIR2      PIR6      PIR11     PIR16     PIR15                  SYS_PD
|  B3      I:004     I:024     I:040     I:054     I:040                    B3
├──┤ ├──────┤ ├───────┤ ├───────┤ ├───────┤ ├───────┤ ├─────────────────────( )───┤
| 303       10        07        07        07        13                      389   |
|[23]                                                                             |
B3/389 - ┤ ├ - File #2 MAIN_PRGRM -  22
        -( )- - File #2 MAIN_PRGRM -  140
```

Rung #141

```
|HEATER                                                    HEATER SHIELD
|SHIELD H2O                                                FLOW SWITCH
|FLOW                                                      1 SENSOR
|SWITCH 1                                                  TIMER
|HSFS1                                                     HSFS1TMR
|  I:006                                                   ┌─TOF──────────────┐
├───┤ ├────────────────────────────────────────────────────┤TIMER OFF DELAY   ├─(EN)─
|    10                                                    |TIMER:    T4:191  |
|                                                          |BASE (SEC):   1.0 ├─(DN) |
| T4:191.DN - ┤ ├ - File #2 MAIN_PRGRM - 147               |PRESET:        20 |      |
|             ┤/├ - File #2 MAIN_PRGRM - 149               |ACCUM:          0 |      |
|                                                          └──────────────────┘      |
```

```
Rung #142
|HEATER                                                              HEATER SHIELD        |
|SHIELD H2O                                                          FLOW SWITCH          |
|FLOW                                                                2 SENSOR             |
|SWITCH 2                                                            HSFS2TMR             |
|HSFS2                                                               +--TOF-----------+   |
|   I:006                                                            |TIMER OFF DELAY |-(EN)-|
|---] [--------------------------------------------------------------|TIMER:   T4:192|   |
|    11                                                              |BASE (SEC):  1.0|-(DN) |
|                                                                    |PRESET:       20|   |
| T4:192.DN - ] [ - File #2 MAIN_PRGRM - 147                         |ACCUM:         0|   |
|             ]/[ - File #2 MAIN_PRGRM - 149                         +----------------+   |
|
Rung #143
|HEATER                                                              HEATER SHIELD        |
|SHIELD H2O                                                          FLOW SWITCH          |
|FLOW                                                                3 TIMER              |
|SWITCH 3                                                            HSFS3TMR             |
|HSFS3                                                               +--TOF-----------+   |
|   I:006                                                            |TIMER OFF DELAY |-(EN)-|
|---] [--------------------------------------------------------------|TIMER:   T4:193|   |
|    12                                                              |BASE (SEC):  1.0|-(DN) |
|                                                                    |PRESET:       20|   |
| T4:193.DN - ] [ - File #2 MAIN_PRGRM - 148                         |ACCUM:         0|   |
|             ]/[ - File #2 MAIN_PRGRM - 150                         +----------------+   |
|
Rung #144
|HEATER                                                              HEATER SHIELD        |
|SHIELD H2O                                                          FLOW SWITCH          |
|FLOW                                                                4 TIMER              |
|SWITCH 4                                                            HSFS4TMR             |
|HSFS4                                                               +--TOF-----------+   |
|   I:006                                                            |TIMER OFF DELAY |-(EN)-|
|---] [--------------------------------------------------------------|TIMER:   T4:194|   |
|    13                                                              |BASE (SEC):  1.0|-(DN) |
|                                                                    |PRESET:       20|   |
| T4:194.DN - ] [ - File #2 MAIN_PRGRM - 148                         |ACCUM:         0|   |
|             ]/[ - File #2 MAIN_PRGRM - 150                         +----------------+   |
|
Rung #145
|HEATER                                                              HEATER SHIELD        |
|SHIELD H2O                                                          FLOW SWITCH          |
|FLOW                                                                5 TIMER              |
|SWITCH 5                                                            HSFS5TMR             |
|HSFS5                                                               +--TOF-----------+   |
|   I:023                                                            |TIMER OFF DELAY |-(EN)-|
|---] [--------------------------------------------------------------|TIMER:   T4:195|   |
|    16                                                              |BASE (SEC):  1.0|-(DN) |
|                                                                    |PRESET:       20|   |
|                                                                    |ACCUM:        20|   |
|                                                                    +----------------+   |
|
```

```
Rung #146
|HEATER
|SHIELD H2O                                                              HEATER SHIELD
|FLOW                                                                    FLOW SWITCH
|SWITCH 6                                                                6 TIMER
|HSFS6                                                                   HSFS6TMR
|  I:023                                                                 +--TOF-----------+
|---] [-----------------------------------------------------------------+|TIMER OFF DELAY |-(EN)-
|    17                                                                  |TIMER:    T4:196|
|                                                                        |BASE (SEC):  1.0|-(DN)
|                                                                        |PRESET:       20|
|                                                                        |ACCUM:        20|
|                                                                        +----------------+

Rung #147
|                                            HEATER 1
|                                            CHAMBER                                        SUBSTRATE
|RUN HEATER                          HEATER  =<250    HEATER WATER  HEATER WATER            HEATER  1A
|GROUP 1                             ALARM   MICRONS  VALVE 1       VALVE 2                 ON
|TS26      HSFS1TMR    HSFS2TMR      HTALM   PIR2     HH201         HH202                   RH1A
|  N7:17     T4:191      T4:192       B3     I:004      O:010         O:010                   O:046
|---] [-------] [---------] [---------]/[------] [--------] [-----------] [-------------------+--(L)--
|     2         DN          DN        530      10         16            17                   |   10
|[3]      [141]       [142]                      [737]         [736]                         |
| O:046/10 - ] [ - - File #2 MAIN_PRGRM - 153                                                |SUBSTRATE
|          -(U)- - File #2 MAIN_PRGRM - 149                                                  |HEATER  1B
| O:046/11 - ] [ - - File #2 MAIN_PRGRM - 153                                                |ON
|          -(U)- - File #2 MAIN_PRGRM - 149                                                  |RH1B
| O:046/15 - -(U)- - File #2 MAIN_PRGRM - 149                                                |  O:046
| O:046/16 - -(U)- - File #2 MAIN_PRGRM - 149                                                +--(L)--
| N7:38/2 - -(U)- - File #2 MAIN_PRGRM - 149                                                 |   11
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                                |
| N7:38/5 - -(L)- - File #2 MAIN_PRGRM - 149                                                 |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                                |SUBSTRATE
|                                                                                            |HEATER  3A
|                                                                                            |ON
|                                                                                            |RH3A
|                                                                                            |  O:046
|                                                                                            +--(L)--
|                                                                                            |   15
|                                                                                            |SUBSTRATE
|                                                                                            |HEATER  3B
|                                                                                            |ON
|                                                                                            |RH3B
|                                                                                            |  O:046
|                                                                                            +--(L)--
|                                                                                            |   16
|                                                                                            |MANUAL
|                                                                                            |RUN HEATER
|                                                                                            |GROUP 1
|                                                                                            |MRHG1
|                                                                                            |  N7:38
|                                                                                            +--(L)--
|                                                                                            |   2
|                                                                                            |MANUAL
|                                                                                            |STOP HEATER
|                                                                                            |GROUP 1
|                                                                                            |MSHG1
|                                                                                            |  N7:38
|                                                                                            +--(U)--
|                                                                                                5
```

Rung #148

```
RUN HEATER                                       CHROME                HEATER WATER  HEATER WATER          SUBSTRATE
GROUP 2                                  HEATER  CHAMBER      DOOR 4   VALVE 1       VALVE 2               HEATER 2A
TS27     HSFS3TMR   HSFS4TMR   ALARM     =<250        OPEN     HH201         HH202                 ON
N7:17    T4:193     T4:194     HTALM     MICRONS      DROP4S   O:010         O:010                 RH2A
                               B3        PIR6         I:006                                        O:046
                                         I:024
--] [------] [-------] [------]/[----+--] [-------] [----+------] [-----------] [-----------------+---(L)---
  3         DN         DN        530 |   07          07  |      16            17                 |   12
[3]       [143]      [144]           |                   |   [737]         [736]                 |
                                     | HEATER 1          |                                       | SUBSTRATE
                                     | CHAMBER           |  O:046/12 - ] [ - File #2 MAIN_PRGRM - 153  | HEATER 2B
                                     | =<250     DOOR 3  |            -(U)- File #2 MAIN_PRGRM - 150  | ON
                                     | MICRONS   OPEN    |  O:046/13 - ] [ - File #2 MAIN_PRGRM - 153  | RH2B
                                     | PIR2      DROP3S  |            -(U)- File #2 MAIN_PRGRM - 150  |   O:046
                                     | I:004     I:006   |  O:046/14 - ] [ - File #2 MAIN_PRGRM - 153  +---(L)---
                                     +--] [-------] [----+            -(U)- File #2 MAIN_PRGRM - 150  |   13
                                        10        05        O:046/17 - -(U)- File #2 MAIN_PRGRM - 150 |
                                                            N7:38/3 - -(U)- - File #2 MAIN_PRGRM - 150 |
                                                            _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 |
                                                                                                   | SUBSTRATE
N7:38/6 - -(L)- - File #2 MAIN_PRGRM - 150                                                         | HEATER 2C
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                                        | ON
                                                                                                   | RH2C
                                                                                                   |   O:046
                                                                                                   +---(L)---
                                                                                                   |   14
                                                                                                   | SUBSTRATE
                                                                                                   | HEATER 3C
                                                                                                   | ON
                                                                                                   | RH3C
                                                                                                   |   O:046
                                                                                                   +---(L)---
                                                                                                   |   17
                                                                                                   | MANUAL
                                                                                                   | RUN HEATER
                                                                                                   | GROUP 2
                                                                                                   | MRHG2
                                                                                                   |   N7:38
                                                                                                   +---(L)---
                                                                                                   |   3
                                                                                                   | MANUAL
                                                                                                   | STOP HEATER
                                                                                                   | GROUP 2
                                                                                                   | MSHG2
                                                                                                   |   N7:38
                                                                                                   +---(U)---
                                                                                                       6
```

Rung #149

```
STOP HEATER                                                    SUBSTRATE
GROUP 1                                                        HEATER 1A
TS29                                                           ON
   N7:17                                                       RH1A
---] [---                                                        O:046
    5                                                          ---(U)---
[3]                                                                10
        O:046/10 - -] [- - File #2 MAIN_PRGRM - 153
                   -(L)- - File #2 MAIN_PRGRM - 147            SUBSTRATE
        O:046/11 - -] [- - File #2 MAIN_PRGRM - 153            HEATER 1B
                   -(L)- - File #2 MAIN_PRGRM - 147            ON
        O:046/15 - -(L)- - File #2 MAIN_PRGRM - 147            RH1B
        O:046/16 - -(L)- - File #2 MAIN_PRGRM - 147              O:046
HSFS1TMR N7:38/2 - -(L)- - File #2 MAIN_PRGRM - 147            ---(U)---
 T4:191  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2               11
---]/[---N7:38/5 - -(U)- - File #2 MAIN_PRGRM - 147
   DN    _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2           SUBSTRATE
[141]                                                          HEATER 3A
                                                               ON
                                                               RH3A
                                                                 O:046
                                                               ---(U)---
                                                                   15
HSFS2TMR
 T4:192                                                        SUBSTRATE
---]/[---                                                      HEATER 3B
   DN                                                          ON
[142]                                                          RH3B
                                                                 O:046
                                                               ---(U)---
                                                                   16
HEATER
ALARM                                                          MANUAL
HTALM                                                          RUN HEATER
   B3                                                          GROUP 1
---] [---                                                      MRHG1
  530                                                            N7:38
                                                               ---(U)---
                                                                   2
HEATER WATER
VALVE 2                                                        MANUAL
HH202                                                          STOP HEATER
   O:010                                                       GROUP 1
---]/[---                                                      MSHG1
    17                                                           N7:38
[736]                                                          ---(L)---
                                                                   5
HEATER WATER
VALVE 1
HH201
   O:010
---]/[---
    16
[737]
AUTO OFF
PULSE
AUOFPULSE
> >          >                                                             >
```

```
T4:283
  TT
[155]
Rung #150
STOP HEATER
GROUP 2
TS30
 N7:17
   6
[3]
0:046/12 - -| |- - File #2 MAIN_PRGRM - 153
           -(L)- - File #2 MAIN_PRGRM - 148
0:046/13 - -| |- - File #2 MAIN_PRGRM - 153
           -(L)- - File #2 MAIN_PRGRM - 148
0:046/14 - -| |- - File #2 MAIN_PRGRM - 153
           -(L)- - File #2 MAIN_PRGRM - 148
0:046/17 - -(L)- - File #2 MAIN_PRGRM - 148
N7:38/3 - -(L)- - File #2 MAIN_PRGRM - 148
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
N7:38/6 - -(U)- - File #2 MAIN_PRGRM - 148
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2

HSFS3TMR
 T4:193
  -|/|-
   DN
[143]

HSFS4TMR
 T4:194
  -|/|-
   DN
[144]

HEATER WATER
VALVE 2
HW202
 0:010
  -|/|-
   17
[736]

HEATER WATER
VALVE 1
HW201
 0:010
  -|/|-
   16
[737]
HEATER
ALARM
HTALM
 B3
   530
AUTO OFF

SUBSTRATE
HEATER 2A
ON
RH2A
 0:046
 -(U)-
   12

SUBSTRATE
HEATER 2B
ON
RH2B
 0:046
 -(U)-
   13

SUBSTRATE
HEATER 2C
ON
RH2C
 0:046
 -(U)-
   14

SUBSTRATE
HEATER 3C
ON
RH3C
 0:046
 -(U)-
   17

MANUAL
RUN HEATER
GROUP 2
MRHG2
 N7:38
 -(U)-
   3
MANUAL
STOP HEATER
GROUP 2
MSHG2
 N7:38
 -(L)-
   6
```

```
| |PULSE          |
| |AUOFPULSE      |
| | T4:283        |
| └──┤ ├──────────┘
|     TT
| [155]
```

Rung #151

```
|HEATER
|ALARM                                                         HEATER ALARM
|HTALM                                                         HTRALM
| B3                                                                  B3
├─┤ ├──────────────────────────────────────────────────────────────(L)──┤
| 530                                                                 290
B3/290 - ┤ ├ - File #2 MAIN_PRGRM - 62?
        -(L)- - File #2 MAIN_PRGRM - 151
        -(U)- - File #2 MAIN_PRGRM - 152
```

Rung #152

```
|PAUSE
|DISABLE                                                       HEATER ALARM
|TS12                                                          HTRALM
| N7:16                                                               B3
├──┤ ├─────────────────────────────────────────────────────────────(U)──┤
|   4                                                                 290
|[3]
B3/290 - ┤ ├ - File #2 MAIN_PRGRM - 62?
        -(L)- - File #2 MAIN_PRGRM - 151
        -(U)- - File #2 MAIN_PRGRM - 152
```

Rung #153

```
|SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE  SUBSTRATE  SUBSTRATE
|HEATER    HEATER    HEATER    HEATER    HEATER    HEATER    HEATER    HEATER    HEATER 1A  HEATER 1B  HEATER 2A
|SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  ON         ON         ON
|HH1A      HH1B      HH2A      HH2B      HH2C      HH3A      HH3B      HH3C      RH1A       RH1B       RH2A
| 0:046    0:046     0:046     0:046     0:046     0:046     0:046     0:046     0:046      0:046      0:046
├──┤/├───────┤/├───────┤/├───────┤/├───────┤/├───────┤/├───────┤/├───────┤/├───────┤ ├────────┤ ├────────┤ ├──
|   00        01        02        03        04        05        06        07        10         11         12
|[213]     [213]     [227]     [227]     [227]     [213]     [213]     [227]     [149]      [149]      [150]

                                                            ALL
                                  SUBSTRATE    SUBSTRATE    SUBSTRATE
                                  HEATER 2B    HEATER 2C    HEATERS
                                  ON           ON           SET LOW
                                  RH2B         RH2C         ASHSL
                                   0:046        0:046         B3
                                 ───┤ ├─────────┤ ├──────────( )──┤
                                    13           14            398
                                  [150]        [150]

B3/398 - ┤ ├ - File #2 MAIN_PRGRM - 158
        -( )- - File #2 MAIN_PRGRM - 153
```

Rung #154

```
|                                                                                     DOORS 1,2,3,9,
|DOOR 1  DOOR 2  DOOR 3  DOOR 9  DOOR 11 DOOR 12 DOOR 4  DOOR 5  DOOR 6  DOOR 7  DOOR 8  DOOR 10    11,12 CLOSED:
|CLOSED  CLOSED  CLOSED  OPEN    CLOSED  CLOSED  OPEN    OPEN    OPEN    OPEN    OPEN    CLOSED     4,5,6,7,8 OPEN
|DRCL1S  DRCL2S  DRCL3S  DROP9S  DRCL11S DRCL12S DROP4S  DROP5S  DROP6S  DROP7S  DROP8S  DRCL10S    DRS_OK
| I:006  I:006   I:006   I:056   I:056   I:056   I:006   I:026   I:026   I:042   I:042   I:056          B3
├─┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├─────┤ ├──────────( )──┤
|  00      02      04      01      04      06      07      01      03      01      03      02            396
B3/396 - ┤ ├ - File #2 MAIN_PRGRM - 158
        -( )- - File #2 MAIN_PRGRM - 154
```

```
Rung #155
|                                                                                AUTO        |
|             POWER SUPPLIES   POWER SUPPLIES                                    MODE        |
| AUTO MODE  CHROME,MAG-A     MAG8,CARBON                                       ENABLE      |
| DISABLE    ON               ON                                                AUTO        |
| TS10       PS_CH_MA_ON      PS_MB_CR_ON                                        N7:37      |
|   N7:16        B3               B3                                                        |
|----] [--------]/[--------------]/[--------------------------------------------+--(U)--+---|
| |   2         527              543         |                                  |  11     |   |
| |[3]                                        |                                  |         |   |
| |                                           |                                  |AUTO OFF |   |
| |FIRST SCAN                                 |                                  |PULSE    |   |
| |AFTER POWER                                |                                  |AUOFPULSE|   |
| |LOSS                                       |                                  |+-TON----+   |
| |PWR_ON_DLY                                 |                                  +|TIMER ON DELAY |-(EN)-+
| |   B3                                      |                                  |TIMER:      T4:283|
| +---] [-------------------------------------+                                  |BASE (SEC):   1.0|-(DN)
|    444                                                                         |PRESET:         5|
|  [1]                                                                           |ACCUM:          0|
|                                                                                +-----------------+
```

N7:37/11 -] [- - File #2 MAIN_PRGRM - 15, 115, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 159, 160, 162, 163, 165, 168, 173, 174, 180, 181, 185, 187, 190, 195, 197, 199, 200, 202, 204, 205, 206, 207, 208, 209, 211, 214, 218, 222, 226, 229, 231, 233, 235, 237, 238, 243, 249, 253, 255, 258, 263, 265, 267, 269, 270, 275, 281, 285, 287, 290, 295, 297, 299, 300, 306, 310, 312, 315, 320, 324, 327, 331, 335, 337, 338, 341, 346, 347, 351, 355, 614, 616, 624, 625, 630, 631, 633

File #5 FAULTS - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

]/[- File #2 MAIN_PRGRM - 84, 98, 104, 116, 187, 200, 212, 327, 369, 405, 411, 418, 425, 430, 674, 676, 684, 688, 690, 698

-(L)- - File #2 MAIN_PRGRM - 158

_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2

T4:283.DN -] [- - File #2 MAIN_PRGRM - 711

T4:283.TT -] [- - File #2 MAIN_PRGRM - 38, 39, 40, 41, 42, 44, 45, 84, 98, 105, 106, 107, 108, 109, 149, 150, 223, 237, 240, 243, 269, 272, 275

```
Rung #156
|OPEN                                                                   GAS FLOW |
|GAS FLOW   GAS FLOW    GAS FLOW                                        VALVES   |
|ISOLATION  ISOLATION   ISOLATION                                       3,5,7    |
|VALVE 3    VALVE 5     VALVE 7                                         ARE OPEN |
|GF3        GF5         GF7                                             MAST-VAL |
|  0:030      0:044       0:060                                            B3    |
|----] [--------] [---------] [-----------------------------------------( )-------|
|    07          07          07                                            148   |
|[40]        [42]        [44]
```

B3/148 -] [- - File #2 MAIN_PRGRM - 158

-( )- - File #2 MAIN_PRGRM - 156

```
Rung #157
|PREPARE                                                          PREPARE FOR |
|FOR AUTO RUN                                                     AUTO RUN    |
|ENABLE                                                           >AUTO       |
|TS09                                                               N7:37     |
|   N7:16                                                                     |
|----] [-------------------------------------------------------------(L)------|
|     1                                                                1      |
|[3]
```

N7:37/1 -] [- - File #2 MAIN_PRGRM - 17,22,46,47,48,49,68,78,110,111,112,113,114,115,118,120,122,124,126,128,130,132,134,136,138, 158,183,202,229,325,335,337,353,368,381,383,385,386,410,415,417,424,429,433,437,441,446,450,454,458,460,462,464,466, 468,470,472,474,476,478,480,482,484,486,488,490,492,494,496,498,500,502,508,509,510,511,512,551,552,553,554,555,556, 557,558,559,560,561,562,563,564,565,566,567,568,569,589,590,591,592,593,594,595,596,597,598,599,600,601,602,603,604, 605,606,607,625

File #3 CRYO_REGEN - 25,238,239,240,241,242,243,244

-(L)- - File #2 MAIN_PRGRM - 157

-(U)- - File #2 MAIN_PRGRM - 162

_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2

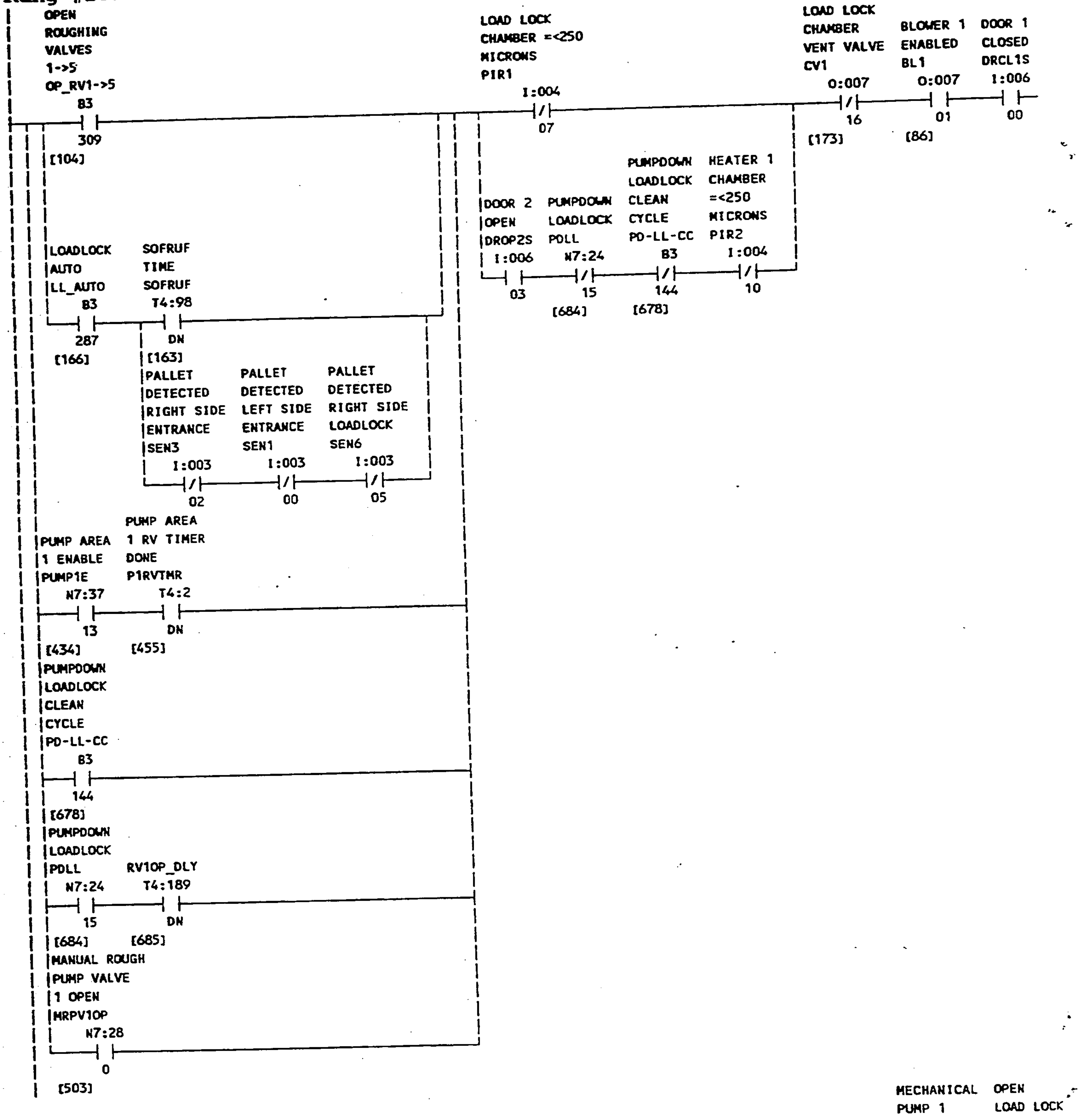
```
Rung #158
|             GAS FLOW                                                                    COMPUTER    ALL
|             VALVES                      MECHANICAL              MECHANICAL              SIGNAL FOR  SUBSTRATE   DOORS 1,2,3,9,
|PREPARE FOR  3,5,7                       PUMP 1       BLOWER 1   PUMP 3       BLOWER 3   AUTO MODE   HEATERS     11,12 CLOSED:
|AUTO RUN     ARE OPEN  DOOR FAULT        ENABLED      ENABLED    ENABLED      ENABLED    OK          SET LOW     4,5,6,7,8 OPEN
|>AUTO        MAST-VAL  DRFLT             MP1          BL1        MP3          BL3        COMPAUTO    ASHSL       DRS_OK
|  N7:37        B3          B3            0:007        0:007      0:057        0:057      N7:16       B3          B3
|----] [-------] [--------]/[-------------] [----------] [---------] [----------] [---------] [---------] [---------] [----
|    1         148         215             00           01         00           01         11          398         396
|[157]       [156]       [5:67]          [89]          [86]       [103]        [100]      [3]         [153]       [154]
| N7:37/11 - ] [ - File #2 MAIN_PRGRM - 15, 115, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138,
|                  159, 160, 162, 163, 165, 168, 173, 174, 180, 181, 185, 187, 190, 195, 197, 199,
|                  200, 202, 204, 205, 206, 207, 208, 209, 211, 214, 218, 222, 226, 229, 231, 233,
|                  235, 237, 238, 243, 249, 253, 255, 258, 263, 265, 267, 269, 270, 275, 281, 285,
|                  287, 290, 295, 297, 299, 300, 306, 310, 312, 315, 320, 324, 327, 331, 335, 337,
|                  338, 341, 346, 347, 351, 355, 614, 616, 624, 625, 630, 631, 633
|                  File #5 FAULTS - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
|          ]/[ - File #2 MAIN_PRGRM - 84, 98, 104, 116, 187, 200, 212, 327, 369, 405, 411, 418, 425,
|                  430, 674, 676, 684, 688, 690, 698
|          -(U)- - File #2 MAIN_PRGRM - 155
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
  T4:282.TT - ] [ - File #2 MAIN_PRGRM - 165, 338, 711
                                                                                            AUTO
                                                                                            MODE
                                                                                            ENABLE
                                                                                            AUTO
                                                                                             N7:37
                                                                                     -------(L)----------
                                                                                     |       11        |
                                                                                     |AUTO ON          |
                                                                                     |PULSE            |
                                                                                     |AUTOPULSE        |
                                                                                     | +-TON--------+  |
                                                                                     +-|TIMER ON DELAY |-(EN)-+
                                                                                       |TIMER:   T4:282|
                                                                                       |BASE (SEC): 1.0|-(DN)
                                                                                       |PRESET:       5|
                                                                                       |ACCUM:        0|
                                                                                       +---------------+

Rung #159
| AUTO                                                                              RETURN CONVEYOR
| MODE                                                                              ON
| ENABLE                                                                            RTNCVYR
| AUTO                                                                                   0:060
|  N7:37
|----] [----------------------------------------------------------------------------------(L)-----
| |   11              |                                                                   01
| |[158]              |
| |                   | 0:060/01 - -(U)- - File #2 MAIN_PRGRM - 161
| |MANUAL CONTROL     |
| |RETURN CONVEYOR    |
| |RTNCNVYR           |
| |     I:055         |
| +------] [----------+
|         03
```

```
Rung #160
| AUTO                                                                    RETURN CONVEYOR
| MODE                                                                    OFF DELAY
| ENABLE                                                                  RC_OFF
| AUTO                                                                    ---TOF-----------
| N7:37                                                                   |TIMER OFF DELAY |-(EN)-
|--+--] [-----------------------------------------------------------------|TIMER:    T4:332|
|  |  11          :                                                       |BASE (SEC):  1.0|-(DN)
|  |[158]         :                                                       |PRESET:     1800|
|  |              : T4:332.DN - -]/[- - File #2 MAIN_PRGRM - 161          |ACCUM:         0|
|  |              :                                                       -----------------
|  |MANUAL CONTROL
|  |RETURN CONVEYOR
|  |RTNCNVYR
|  |       I:055
|  +-------] [------
|          03
Rung #161
|                                                                         RETURN CONVEYOR
|                                                                         ON
|RC_OFF                                                                   RTNCVYR
| T4:332                                                                     O:060
|--]/[------------------------------------------------------------------------(U)------
|   DN                                                                        01
|[160]
O:060/01 - -(L)- - File #2 MAIN_PRGRM - 159
           -(U)- - File #2 MAIN_PRGRM - 161
Rung #162
| AUTO MODE                                                               PREPARE FOR
| DISABLE                                                                 AUTO RUN
| TS10                                                                    >AUTO
|     N7:16                                                                  N7:37
|--+------] [------------------------------------------------------------------(U)------
|  |       2       :
|  |[3]            :
|  |               : N7:37/1 - -] [- - File #2 MAIN_PRGRM - 17, 22, 46, 47, 48, 49, 68, 78, 110, 111, 112, 113, 114, 115,
|  |               :     118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 158, 183, 202, 229, 325,
|  |               :     335, 337, 353, 368, 381, 383, 385, 386, 410, 415, 417, 424, 429, 433, 437, 441,
|  |AUTO           :     446, 450, 454, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482,
|  |MODE           :     484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 508, 509, 510, 511, 512, 551,
|  |ENABLE               552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567,
|  |AUTO                 568, 569, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602,
|  | N7:37               603, 604, 605, 606, 607, 625
|  +--] [-------         File #3 CRYO_REGEN - 25, 238, 239, 240, 241, 242, 243, 244
|     11                  -(L)- - File #2 MAIN_PRGRM - 157
| [158]       _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 3
Rung #163
|                              PALLET
|AUTO                          DETECTED                                   SOFT
|MODE    DOOR 1   DOOR 2       RIGHT SIDE                                 ROUGHING
|ENABLE  CLOSED   CLOSED       LOADLOCK                                   TIMER
|AUTO    DRCL1S   DRCL2S       SEN6                                       SOFRUF
| N7:37   I:006    I:006        I:003                                     ---TON-----------
|--] [-----] [------] [----------] [--------------------------------------|TIMER ON DELAY  |-(EN)-
|  11       00       02           05                                      |TIMER:     T4:98|
|[158]                                                                    |BASE (SEC):  1.0|-(DN)
|                                                                         |PRESET:        0|
|                                                                         |ACCUM:         0|
|                                                                         -----------------
T4:98.DN - -] [- - File #2 MAIN_PRGRM - 167
T4:98.TT - -] [- - File #2 MAIN_PRGRM - 164
```

```
Rung #164
                                                              MECH PUMP
                                                              SOFT ROUGH
                                                              VALVE
SOFRUF                                                        SOFRUFVLV
 T4:98                                                          O:030
-| |------------------------------------------------------------( )--
 TT                                                               00
[163]
Rung #165
                                                              LOADLOCK
                                                              AUTO
  AUTOPULSE                                                   LL_AUTO
   T4:282                                                        B3
---| |------------------------------------------------------------(L)--
     TT                                                          287
 [158]
                      B3/287 - -| |- - File #2 MAIN_PRGRM - 167, 183
                               -(U)- - File #2 MAIN_PRGRM - 166
          COMPUTER
 AUTO     SIGNAL FOR
 MODE     AUTO MODE
 ENABLE   OK
 AUTO     COMPAUTO
  N7:37     N7:16
 --| |--------| |--
    11          11
 [158]     [3]
Rung #166
 VENT                                                         LOADLOCK
 LOAD LOCK                                                    AUTO
 VNT_LL                                                       LL_AUTO
   N7:24                                                         B3
---| |------------------------------------------------------------(U)--
     13                                                          287
 [674]
              B3/287 - -| |- - File #2 MAIN_PRGRM - 167, 183
                       -(L)- - File #2 MAIN_PRGRM - 165
 PUMP-VENT
 CYCLE LOAD
 LOCK
 PD-VNT-LL
   N7:24
 ----| |----
     14
 [676]
 AUTO MODE
 DISABLE
 TS10
   N7:16
 ----| |----
     2
 [3]
```

Rung #167


OPEN ROUGHING VALVES 1->5 OP_RV1->5
B3
309
[104]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
OPEN LOAD LOCK CHAMBER VENT VALVE CV1
O:007
16
[173]
BLOWER 1 ENABLED BL1
O:007
01
[86]
DOOR 1 CLOSED DRCL1S
I:006
00
DOOR 2 OPEN DROP2S
I:006
03
PUMPDOWN LOADLOCK POLL
N7:24
15
[684]
PUMPDOWN LOADLOCK CLEAN CYCLE PD-LL-CC
B3
144
[678]
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
LOADLOCK AUTO LL_AUTO
B3
287
[166]
SOFRUF TIME SOFRUF
T4:98
DN
[163]
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3
I:003
02
PALLET DETECTED LEFT SIDE ENTRANCE SEN1
I:003
00
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
PUMP AREA 1 ENABLE PUMP1E
N7:37
13
[434]
PUMP AREA 1 RV TIMER DONE P1RVTMR
T4:2
DN
[455]
PUMPDOWN LOADLOCK CLEAN CYCLE PD-LL-CC
B3
144
[678]
PUMPDOWN LOADLOCK POLL
N7:24
15
[684]
RV1OP_DLY
T4:189
DN
[685]
MANUAL ROUGH PUMP VALVE 1 OPEN MRPV1OP
N7:28
0
[503]
MECHANICAL PUMP 1
OPEN LOAD LOCK

```
                                                           ISOLATION   ROUGH
                                                           VALVE OPEN  VALVE
                                                           MP1IVOP     RV1
                                                            I:005      O:010
                                                           ---| |-------( )---
                                                               13         11

O:010/11 - -| |- - File #2 MAIN_PRGRM -  168
                   File #5 FAULTS -  159
                   File #6 TECH_RUNGS -  0
           -|/|- - File #5 FAULTS -  161
           -( )- - File #2 MAIN_PRGRM -  167
```

Rung #168

```
|        OPEN
|AUTO    LOAD LOCK
|MODE    ROUGH                                           LOAD LOCK
|ENABLE  VALVE                                           ROUGH TIMER
|AUTO    RV1                                             LLRUFFTMR
| N7:37   O:010                                          +-TON-------------+
|--| |-----| |-------------------------------------------|TIMER ON DELAY   |-(EN)-
|   11      11                                           |TIMER:    T4:113 |
|[158]    [167]                                          |BASE (SEC):  1.0 |-(DN)
|                                                        |PRESET:       60 |
|                                                        |ACCUM:         0 |
|                                                        +-----------------+
T4:113.DN - -| |- - File #2 MAIN_PRGRM -  169
```

Rung #169

```
|                                                              LOAD LOCK
|                                                              ROUGHING
|                                                              >60 SECONDS
|LLRUFFTMR                                                     LLRUF>60
| T4:113                                                          B3
|---| |----------------------------------------------------------(L)---
|    DN                                                           816
|[168]
B3/816 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  169
         -(U)- - File #2 MAIN_PRGRM -  170
```

Rung #170

```
|                                                              LOAD LOCK
|PAUSE                                                         ROUGHING
|DISABLE                                                       >60 SECONDS
|TS12                                                          LLRUF>60
| N7:16                                                           B3
|---| |----------------------------------------------------------(U)---
|    4                                                            816
|[3]
B3/816 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  169
         -(U)- - File #2 MAIN_PRGRM -  170
```

Rung #171

VENT 1 STAGE 1 V1ST1 B3 412 [409]

HEATER 1 CHAMBER GATE VALVE CLOSE HV1S1 I:002 06

T4:1.DN - — — · File #2 MAIN_PRGRM - 173

DOOR 1 CLOSED DRCL1S I:006 00

VENT 1 STAGE1 DELAY TIMER V1DYTMR

TON
TIMER ON DELAY —(EN)—
TIMER: T4:1
BASE (SEC): 1.0 —(DN)
PRESET: 5
ACCUM: 0

Rung #172

DOOR 2 CLOSED DRCL2S I:006 02

T4:201.DN - — — · File #2 MAIN_PRGRM - 173

VENT DELAY ON DOOR 2 CLOSE. VDDR2CL

TON
TIMER ON DELAY —(EN)—
TIMER: T4:201
BASE (SEC): 1.0 —(DN)
PRESET: 2
ACCUM: 0

Rung #173

AUTO MODE ENABLE AUTO N7:37 11 [158] — LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04 — PALLET DETECTED LEFT SIDE ENTRANCE SEN1 I:003 00 — PALLET DETECTED LEFT SIDE LOADLOCK SEN4 I:003 03 — PALLET DETECTED CENTER LOADLOCK SEN5 I:003 04 — PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05 — LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15 — DOOR 1 CLOSED DRCL1S I:006 00 — DELAY TIMER VDDR2CL T4:201 DN [172] — DOOR 3 CLOSED DRCL3S I:006 04 — LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15

HEATER 1 CHAMBER GATE VALVE CLOSE HV1S1 I:002 06

HEATER 2 CHAMBER GATE VALVE CLOSE HV2S1 I:004 00

MANUAL CONTROL CHAMBER VENT 1 OPEN M-CV1-1 N7:6 11 [3]

READY TO VENT RTVCVDT T4:0 DN [392]

10 SECOND TIMER DONE V1DYTMR T4:1 DN [171]

MANUAL CONTROL CHAMBER VENT 1 OPEN M-CV1-1 N7:6 11 [3]

VENT LOAD LOCK VNT_LL N7:24 13 [674] — DOOR 1 CLOSED DRCL1S I:006 00 — DOOR 2 CLOSED DRCL2S I:006 02 — LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04

VENT LOADLOCK CLEAN CYCLE VNT-LL-CC B3 145 [680] — LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04

OPEN LOAD LOCK

```
                                                              CHAMBER
                                                              VENT VALVE
                                                              CV1
                                                                 O:007
                                                              ----(L)----
                                                                 16

O:007/16 - -| |- - File #2 MAIN_PRGRM -  174
                   File #6 TECH_RUNGS -  0
           -|/|- - File #2 MAIN_PRGRM -  67,167,181,181,368,436,675,681
           -(L)- - File #2 MAIN_PRGRM -  173
           -(U)- - File #2 MAIN_PRGRM -  177
```

Rung #174

```
|        OPEN
|AUTO    LOAD LOCK                                     ENTRANCE
|MODE    CHAMBER                                       LOCK VENT
|ENABLE  VENT VALVE                                    TIMER
|AUTO    CV1                                           LDVNTTIMER
| N7:37     O:007                                      +-TON-----------+
|--| |------| |----------------------------------------|TIMER ON DELAY |-(EN)-
|  11       16                                         |TIMER:  T4:143 |
|[158]   [173]                                         |BASE (SEC): 1.0|-(DN)
|                                                      |PRESET:     100|
|                                                      |ACCUM:        0|
|                                                      +---------------+

T4:143.DN - -| |- - File #2 MAIN_PRGRM -  175
```

Rung #175

```
|                                                      LOAD LOCK
|                                                      VENT >30 SECS
|LDVNTTIMER                                            LLVNT>30SECS
|  T4:143                                                  B3
|----| |-------------------------------------------------(L)----
|     DN                                                  814
|[174]
B3/814 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  175
         -(U)- - File #2 MAIN_PRGRM -  176
```

Rung #176

```
|PAUSE                                                 LOAD LOCK
|DISABLE                                               VENT >30 SECS
|TS12                                                  LLVNT>30SECS
| N7:16                                                    B3
|---| |--------------------------------------------------(U)----
|    4                                                    814
|[3]
B3/814 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  175
         -(U)- - File #2 MAIN_PRGRM -  176
```

Rung #177

```
|                                                                     OPEN
|                                                                     LOAD LOCK   |
|                                                                     CHAMBER     |
|                                                                     VENT VALVE  |
| CV1_DLY                                                             CV1         |
|  T4:317                                                               0:007     |
|--+--] [--+----------------------------------------------------------------(U)---|
|  |   DN  |                                                               16     |
|  |[178]  |                                                                      |
|  |       | 0:007/16 - ] [ - - File #2 MAIN_PRGRM - 174                          |
|  |MANUAL |                    File #6 TECH_RUNGS - 0                            |
|  |CONTROL|            ]/[ - - File #2 MAIN_PRGRM - 67, 167, 181, 368, 436, 675, 681
|  |CHAMBER|            -(L)- - File #2 MAIN_PRGRM - 173                          |
|  |VENT 1 |                                                                      |
|  |CLOSE  |                                                                      |
|  |M-CV1-0|                                                                      |
|  | N7:4  |                                                                      |
|  +--] [--+                                                                      |
|  |   0   |                                                                      |
|  |[3]    |                                                                      |
|  |HEATER 1                                                                      |
|  |CHAMBER                                                                       |
|  |GATE VALVE  DOOR 2                                                            |
|  |CLOSE       CLOSED                                                            |
|  |HV1S1       DRCL2S                                                            |
|  |  I:002      I:006                                                            |
|  +---]/[-------]/[---+                                                          |
|  |    06         02  |                                                          |
|  |ABORT SYSTEM       |                                                          |
|  |VENT               |                                                          |
|  |BORT_SYS_VNT       |                                                          |
|  |  N7:17            |                                                          |
|  +----] [------------+                                                          |
|        10                                                                        |
|  [3]
```

Rung #178

```
|LLOCK                                                                            |
|CHAMBER                                                                          |
|PRESSUR AT                                            CHAMBER VENT 1             |
|ATMOSPHERE                                            CLOSE DELAY                |
|PS2                                                   CV1_DLY                    |
|  I:002                                               +-TON--------------+       |
|----] [-----------------------------------------------+TIMER ON DELAY    +-(EN)-|
|    04                                                |TIMER:    T4:317  |       |
|                                                      |BASE (SEC):  1.0  +-(DN) |
| T4:317.DN - ] [ - - File #2 MAIN_PRGRM - 177         |PRESET:        1  |       |
|                                                      |ACCUM:         0  |       |
|                                                      +------------------+       |
```

Rung #179

```
|                                                                    LOAD LOCK   |
|DOOR 1                                                              AIR SWEEP   |
|OPEN                                                                SOLENOID    |
|DROP1S                                                              LLSWEEP     |
| I:006                                                                0:011     |
|---] [--------------------------------------------------------------------( )---|
|  01                                                                   10       |
```

Rung #180

AUTO MODE ENABLE AUTO N7:37 11 [158]

DOOR 1 OPEN DROP1S I:006 01

OPEN DOOR 1 DROP1 O:011 01 [181]

T4:77.TT - -|/|- - File #2 MAIN_PRGRM - 181

PALLET GATE TIMER PAL_GTE

TON
TIMER ON DELAY (EN)
TIMER: T4:77
BASE (SEC): 1.0 (DN)
PRESET: 115
ACCUM: 45

Rung #181

AUTO MODE ENABLE AUTO N7:37 11 [158]

PAL_GTE T4:77 TT [180]

PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02

PALLET DETECTED CENTER LOADLOCK SEN5 I:003 04

OPEN LOAD LOCK CHAMBER VENT VALVE CV1 O:007 16 [177]

PAUSE LATCH ENABLE PLE N7:37 3 [625]

LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04

DOOR 1 OPEN DROP1S I:006 01

OPEN DOOR 1 DROP1 O:011 ( ) 01

MANUAL CONTROL OPEN DOOR 1 M-DROP-1 N7:11 7 [3]

MANUAL DOOR 1 OPEN MDR1OP N7:32 (L) 7

MANUAL DOOR 1 CLOSE MDR1CL N7:32 (U)

PAL_GTE T4:77 TT [180]

PUMP-VENT CYCLE LOAD LOCK PD-VNT-LL N7:24 14 [676]

THREE CYCLES COMPLETE LL-CCC C5:9 DN [682]

OPEN LOAD LOCK CHAMBER VENT VALVE CV1 O:007 16 [177]

MANUAL CONTROL OPEN DOOR 1 M-DROP-1 N7:11 7 [3]

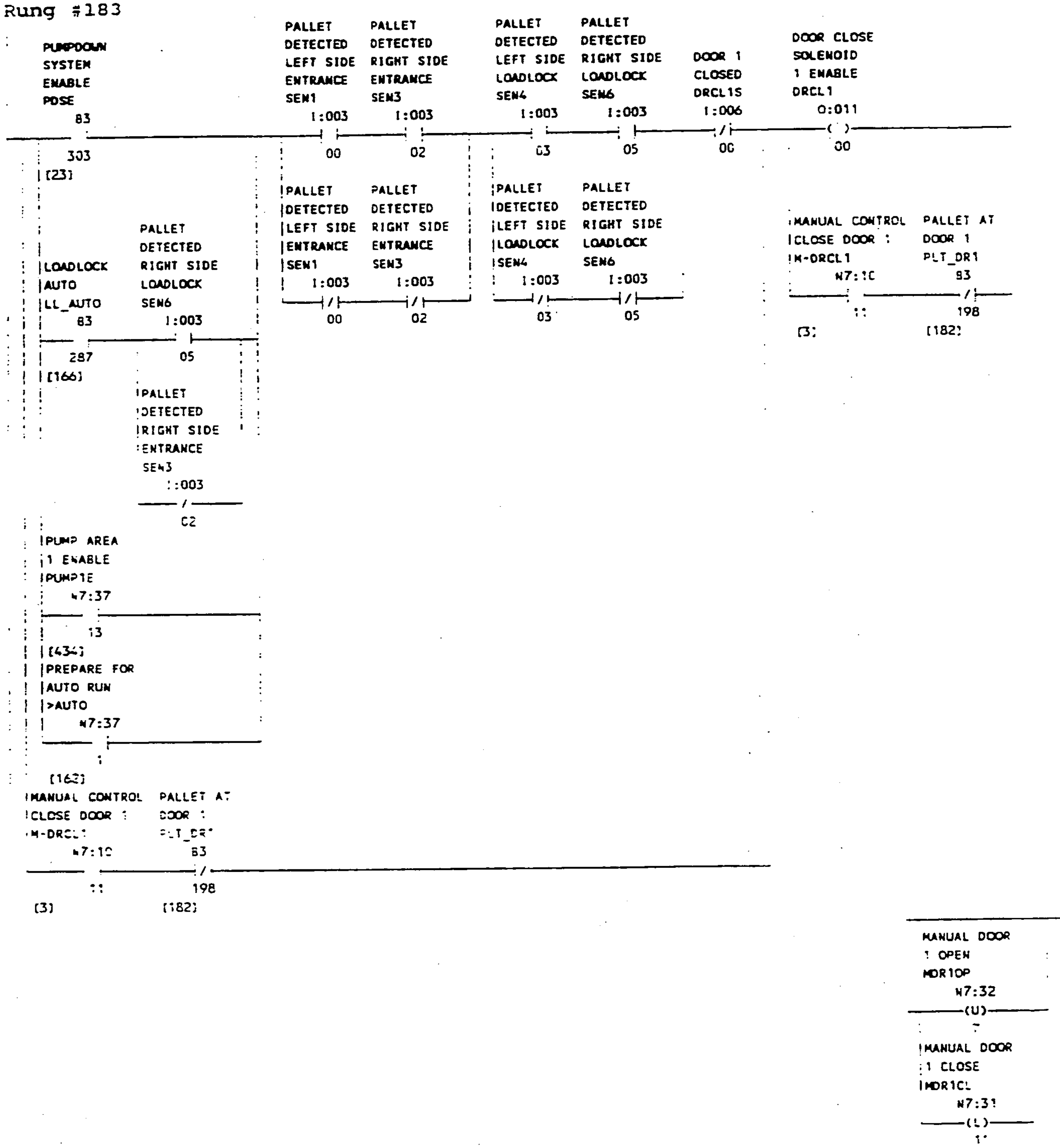
O:011/01 - -| |- - File #5 FAULTS - 41
File #6 TECH_RUNGS - 2
-|/|- - File #2 MAIN_PRGRM - 180

```
         -( )- - File #2 MAIN_PRGRM    181
N7:32/7 - -(L)- - File #2 MAIN_PRGRM -  181
         -(U)- - File #2 MAIN_PRGRM -  183
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/11 - -(L)- - File #2 MAIN_PRGRM -  183
         -(U)- - File #2 MAIN_PRGRM -  181
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #182

```
  PALLET     PALLET      PALLET                                    PALLET AT
  DETECTED   DETECTED    DETECTED                                  DOOR :
  CENTER     RIGHT SIDE  LEFT SIDE                                 FLT_DR1
  ENTRANCE   ENTRANCE    LOADLOCK                                    B3
  SEN2       SEN3        SEN4
   I:003      I:003       I:003
--+--] [--+----] [----------] [--------------------------------------( )--
  |   01  |    02          03                                        198
  |PALLET | B3/198 - -/|- - File #2 MAIN_PRGRM - 183
  |DETECTED|
  |CENTER |
  |LOADLOCK|
  |SEN5   |
  | I:003 |
  +--] [--+
      04
```

Rung #183


PUMPDOWN SYSTEM ENABLE PDSE
B3
303
[23]
PALLET DETECTED LEFT SIDE ENTRANCE SEN1
I:003
00
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3
I:003
02
PALLET DETECTED LEFT SIDE LOADLOCK SEN4
I:003
03
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
DOOR 1 CLOSED DRCL1S
I:006
00
DOOR CLOSE SOLENOID 1 ENABLE DRCL1
O:011
00
LOADLOCK AUTO LL_AUTO
B3
287
[166]
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3
I:003
02
MANUAL CONTROL CLOSE DOOR 1 M-DRCL1
N7:10
11
[3]
PALLET AT DOOR 1 PLT_DR1
B3
198
[182]
PUMP AREA 1 ENABLE PUMP1E
N7:37
13
[434]
PREPARE FOR AUTO RUN >AUTO
N7:37
1
[162]
MANUAL DOOR 1 OPEN MDR1OP
N7:32
(U)
MANUAL DOOR 1 CLOSE MDR1CL
N7:31
(L)

225

```
O:011/00 - -] [- - File #5 FAULTS -
                   File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  183
N7:32/7 - -(L)- - File #2 MAIN_PRGRM -  181
         -(U)- - File #2 MAIN_PRGRM -  183
_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/11 - -(L)- - File #2 MAIN_PRGRM -  183
         -(U)- - File #2 MAIN_PRGRM -  181
_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #184

```
| MOTOR 3       MOTOR START                         MOTOR 3
| FAST PULSE    PULSE                               INTERRUPT
| M3FP          MOPTB                               M3I
|   T4:203        T4:299                              O:012
|-+---] [---+-----] [-----------------------------------( )---
| |   TT    |     DN                                    02
| | [185]   |  [12]
| |MOTOR 3  |
| |FAST STOP|
| |PULSE    |
| |M3FSP    |
| |  T4:223 |
| |---] [---|
| |   TT    |
| |[186]    |
| |MOTOR 3  |
| |SLOW PULSE
| |M3SP     |
| |  T4:243 |
| |---] [---|
| |   TT    |
| |[187]    |
| |MOTOR 3  |
| |SLOW STOP|
| |PULSE    |
| |M3SSP    |
| |  T4:263 |
| |---] [---|
|     TT
|  [188]
```

```
Rung #185
|         PALLET                  PALLET
| AUTO    DETECTED                DETECTED             PAUSE PALLET                                    MOTOR 3
| MODE    RIGHT SIDE    DOOR 2    RIGHT SIDE  DOOR 1   IN ENTRANCE    MOTOR 3                          FAST
| ENABLE  ENTRANCE      CLOSED    LOADLOCK    OPEN     MOTOR 3        REVERSE                          M3F
| AUTO    SEN3          DRCL2S    SEN6        DROP1S   M3PLL          M3R                              O:012
|  N7:37     I:003       I:006     I:003      I:006        B3             B3
+---] [-----+--] [--+-----] [-------]/[--------] [------------]/[-----------]/[-------------------------( )--
| |  11     |  02   |     02         05         01    :    473            103                           12
| |[158]    |       |                                 : [628]          [570]
| |         |PALLET |
| |         |DETECTED                                                                                  MOTOR 3
| |         |LEFT SIDE                                                                                 FAST PULSE
| |         |LOADLOCK                                                                                  M3FP
| |         |SEN4   |                                                                               +-TON-----------------+
| |         |  I:003|                                                                               +-TIMER ON DELAY      +-(EN)-
| |         +--] [--+                                                                                |TIMER:       T4:203 |
| |             03                                                                                   |BASE (SEC):    0.01 +-(DN)
| |                                                                                                  |PRESET:         100 |
| |         PALLET     PALLET                                                                        |ACCUM:            0 |
| |AUTO     DETECTED   DETECTED                                                                      +---------------------+
| |MODE     LEFT SIDE  RIGHT SIDE
| |ENABLE   ENTRANCE   ENTRANCE
| |AUTO     SEN1       SEN3
| | N7:37    I:003      I:003
| +--] [------] [--------]/[--------------
|     11      00         02
| |[158]
| |MANUAL MOTOR      DOOR 1
| |3 ON              OPEN
| |MM3ON             DROP1S
| |   N7:23          I:006
| +----] [-------+----] [------+------------
|        1       |     01      |
|  [513]         |             |
|                |PALLET       |
|                |DETECTED     |
|                |RIGHT SIDE   |
|                |ENTRANCE     |
|                |SEN3         |
|                |   I:003     |
|                +----]/[------+
|                      02
O:012/12 - -] [- - File #5 FAULTS - 0
           -]/[- - File #2 MAIN_PRGRM - 186
           -( )- - File #2 MAIN_PRGRM - 185
T4:203.TT - -] [- - File #2 MAIN_PRGRM - 184
Rung #186
|                                                                                     MOTOR 3
|MOTOR 3                                                                              FAST STOP
|FAST                                                                                 PULSE
|M3F                                                                                  M3FSP
| O:012                                                                             +-TON-----------------+
+---]/[-----------------------------------------------------------------------------+-TIMER ON DELAY      +-(EN)-
|   12                                                                              |TIMER:       T4:223 |
|[185]                                                                              |BASE (SEC):    0.01 +-(DN)
|                                                                                   |PRESET:         100 |
|                                                                                   |ACCUM:          102 |
|                                                                                   +---------------------+
T4:223.TT - -] [- - File #2 MAIN_PRGRM - 184
```

```
Rung #187
                          AUTO                          PAUSE PALLET
  MANUAL MOTOR            MODE        DOOR 1            IN ENTRANCE                         MOTOR 3
  3 ON                    ENABLE      OPEN              MOTOR 3                             SLOW
  MM3ON                   AUTO        DROP1S            M3PLL                               M3S
     N7:23                N7:37       I:006                B3                                 O:013
----] [----------------]/[---------] [--------------]/[---------------------------------------( )----
     11                   11          01                  473                                  02
  [513]                  [158]                          [628]
                                  |PALLET
                                  |DETECTED            O:013/02 - - ] [ - File #2 MAIN_PRGRM - 15, 187
                                  |RIGHT SIDE                   ]/[ - File #2 MAIN_PRGRM - 188      MOTOR 3
                                  |ENTRANCE            T4:243.TT - - - - File #2 MAIN_PRGRM - 184    SLOW PULSE
                                  |SEN3                                                             M3SP
                                  |   I:003                                                         +--TON----------------+
                                  +----]/[----+                                                    -|TIMER ON DELAY       |-(EN)-
                                        02                                                          |TIMER:        T4:243 |
                                                                                                    |BASE (SEC):     0.01 |-(DN)
          PALLET       PALLET                                                                       |PRESET:          100 |
  |AUTO   DETECTED     DETECTED                                                                     |ACCUM:             0 |
  |MODE   LEFT SIDE    RIGHT SIDE                                                                   +---------------------+
  |ENABLE ENTRANCE     ENTRANCE
  |AUTO   SEN1         SEN3
  | N7:37    I:003        I:003
  +--] [------] [---------]/[----------+
      11       00           02
  [158]
                       PALLET
  |AUTO                DETECTED
  |MODE    MOTOR 3     RIGHT SIDE
  |ENABLE  SLOW        ENTRANCE
  |AUTO    M3S         SEN3
  | N7:37    O:013        I:003
  +--] [------] [---------]/[----------+
      11       02           02
  [158]     [187]
            PALLET
            DETECTED     AUTO
  |MOTOR 3  LEFT SIDE    MODE
  |REVERSE  ENTRANCE     ENABLE
  |M3R      SEN1         AUTO
  |  B3       I:003       N7:37
  +--] [-------]/[---------]/[---------+
     103       00           11
  [570]                   [158]
Rung #188
                                                                                                    MOTOR 3
  |MOTOR 3                                                                                          SLOW STOP
  |SLOW                                                                                             PULSE
  |M3S                                                                                              M3SSP
  |  O:013                                                                                          +--TON----------------+
----]/[---------------------------------------------------------------------------------------------|TIMER ON DELAY       |-(EN)-
     02                                                                                             |TIMER:        T4:263 |
  [187]                                                                                             |BASE (SEC):     0.01 |-(DN)
                                                                                                    |PRESET:          100 |
                                                                                                    |ACCUM:           102 |
                                                                                                    +---------------------+

  T4:263.TT - - - - File #2 MAIN_PRGRM - 15-
```

Rung #189

```
| MOTOR 4      MOTOR START                                  MOTOR 4    |
| FAST PULSE   PULSE                                        INTERRUPT  |
| M4FP         MDPTB                                        M4I        |
|   T4:204      T4:299                                        O:012    |
|-+---] [---+----] [-------------------------------------------( )----|
| |   TT    |     DN                                            03     |
| |[190]    |  [12]                                                    |
| |MOTOR 4  |                                                          |
| |FAST STOP|                                                          |
| |PULSE    |                                                          |
| |M4FSP    |                                                          |
| | T4:224  |                                                          |
| +---] [---+                                                          |
| |   TT    |                                                          |
| |[191]    |                                                          |
| |MOTOR 4  |                                                          |
| |SLOW PULSE                                                          |
| |M4SP     |                                                          |
| |  T4:244 |                                                          |
| +---] [---+                                                          |
| |   TT    |                                                          |
| |[192]    |                                                          |
| |MOTOR 4  |                                                          |
| |SLOW STOP|                                                          |
| |PULSE    |                                                          |
| |M4SSP    |                                                          |
| | T4:264  |                                                          |
| +---] [---+                                                          |
|     TT                                                               |
|  [193]                                                               |
```

Rung #190

AUTO MODE ENABLE AUTO N7:37 11 [158]

DOOR 1 OPEN DROP1S I:006 01

DOOR 2 CLOSED DRCL2S I:006 02

PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05

PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02

PALLET DETECTED LEFT SIDE LOADLOCK SEN4 I:003 03

PAUSE PALLET IN LLOCK MOTOR 4 M4PLL B3 401 [628]

MOTOR 4 REVERSE M4R B3 104 [571]

MOTOR 4 FAST M4F O:012 13

MOTOR 4 FAST PULSE M4FP

TON
TIMER ON DELAY (EN)
TIMER: T4:204
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 16

PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05

DOOR 2 OPEN DROP2S I:006 03

PALLET DETECTED RIGHT SIDE HEATER 1 SEN9 I:003 10

MANUAL MOTOR 4 ON MM4ON N7:23 2 [514]

DOOR 2 OPEN DROP2S I:006 03

PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05

O:012/13 - -| |- - File #5 FAULTS - 1
-|/|- - File #2 MAIN_PRGRM - 191
-( )- - File #2 MAIN_PRGRM - 190
T4:204.TT - -| |- - File #2 MAIN_PRGRM - 189

Rung #191

MOTOR 4 FAST M4F O:012 13 [190]

MOTOR 4 FAST STOP PULSE M4FSP

TON
TIMER ON DELAY (EN)
TIMER: T4:224
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

T4:224.TT - -| |- - File #2 MAIN_PRGRM - 189

Rung #192

MANUAL MOTOR 4 ON MM4ON W7:23 2 [514]

DOOR 2 OPEN DROP2S I:006 03

PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05

PAUSE PALLET IN LLOCK MOTOR 4 M4PLL B3 401 [628]

MOTOR 4 SLOW M4S O:013 03

MOTOR 4 REVERSE M4R B3 104 [571]

DOOR 1 OPEN DROP1S I:006 01

PALLET DETECTED LEFT SIDE LOADLOCK SEN4 I:003 03

O:013/03 - —/— - File #2 MAIN_PRGRM - 193

T4:244.TT - — — - File #2 MAIN_PRGRM - 189

MOTOR 4 SLOW PULSE M4SP

TON
TIMER ON DELAY (EN)
TIMER: T4:244
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

Rung #193

MOTOR 4 SLOW M4S O:013 03 [192]

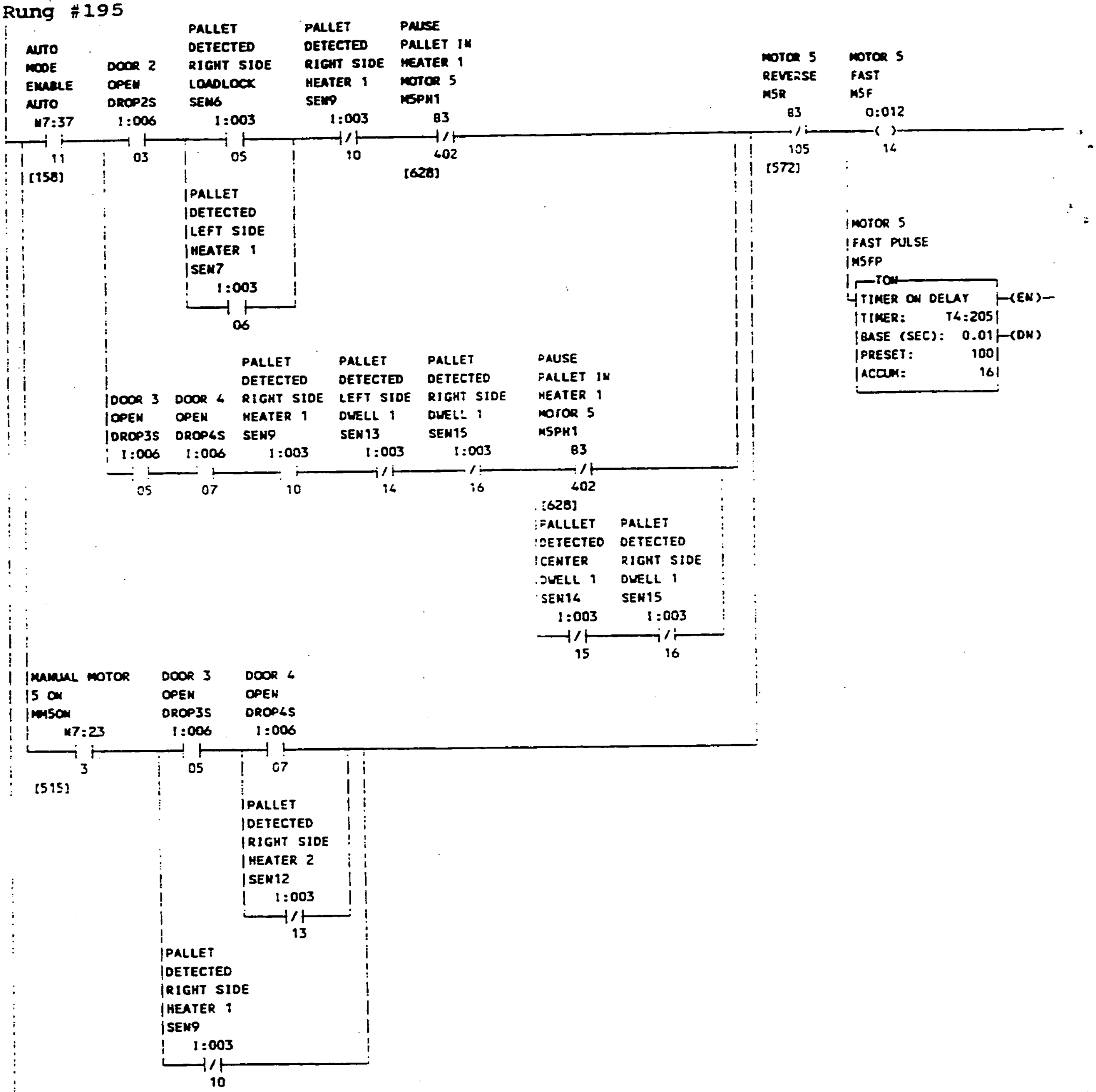
MOTOR 4 SLOW STOP PULSE M4SSP

TON
TIMER ON DELAY (EN)
TIMER: T4:264
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 102

T4:264.TT - — — - File #2 MAIN_PRGRM - 189

```
Rung #194
| MOTOR 5       MOTOR START                                             MOTOR 5
| FAST PULSE    PULSE                                                   INTERRUPT
| M5FP          MDPTB                                                   M5I
|   T4:205        T4:299                                                  O:012
|----] [-----+-----] [----------------------------------------------------( )----
| |    TT    |       DN                                                    04
| |[195]     |  [12]
| |MOTOR 5   |
| |FAST STOP |
| |PULSE     |
| |M5FSP     |
| |  T4:225  |
| |----] [---|
| |    TT    |
| |[196]     |
| |MOTOR 5   |
| |SLOW PULSE|
| |M5SP      |
| |  T4:245  |
| |----] [---|
| |    TT    |
| |[197]     |
| |MOTOR 5
| |SLOW STOP
| |PULSE
| |M5SSP
| |  T4:265
|  ----] [---
       TT
  [198]
```

Rung #195



O:012/14 - -] [- - File #5 FAULTS - 2
-]/[- - File #2 MAIN_PRGRM - 196
-( )- - File #2 MAIN_PRGRM - 195

T4:205.TT - — — - File #2 MAIN_PRGRM 194

Rung #196

MOTOR 5
FAST
M5F
0:012
—/—
14
[195]

MOTOR 5
FAST STOP
PULSE
M5FSP
—TON—
TIMER ON DELAY —(EN)—
TIMER: T4:225
BASE (SEC): 0.01—(DN)
PRESET: 100
ACCUM: 0

T4:225.TT - — — - File #2 MAIN_PRGRM - 194

Rung #197

AUTO MODE ENABLE AUTO N7:37 11 [158]

DOOR 3 OPEN DROP3S I:006 05

DOOR 4 OPEN DROP4S I:006 07

PALLET DETECTED RIGHT SIDE HEATER 1 SEN9 I:003 10

PALLET DETECTED LEFT SIDE DWELL 1 SEN13 I:003 14

PALLET DETECTED RIGHT SIDE DWELL 1 SEN15 I:003 16

PAUSE PALLET IN HEATER 1 MOTOR 5 M5PH1 B3 402 [628]

MOTOR 5 SLOW M5S 0:013 ( ) 04

PALLLET DETECTED CENTER DWELL 1 SEN14 I:003 15

PALLET DETECTED RIGHT SIDE DWELL 1 SEN15 I:003 16

MOTOR 5
SLOW PULSE
M5SP
—TON—
TIMER ON DELAY —(EN)—
TIMER: T4:245
BASE (SEC): 0.01—(DN)
PRESET: 100
ACCUM: 0

MANUAL MOTOR 5 ON M5ON N7:23 2 [515]

DOOR 3 OPEN DROP3S I:006 05

DOOR 4 OPEN DROP4S I:006 07

PALLET DETECTED RIGHT SIDE HEATER 2 SEN12 I:003 13

PALLET DETECTED RIGHT SIDE HEATER 1 SEN9 I:003 10

MOTOR 5 REVERSE M5R B3 105 [572]

DOOR 2 OPEN DROP2S I:006 03

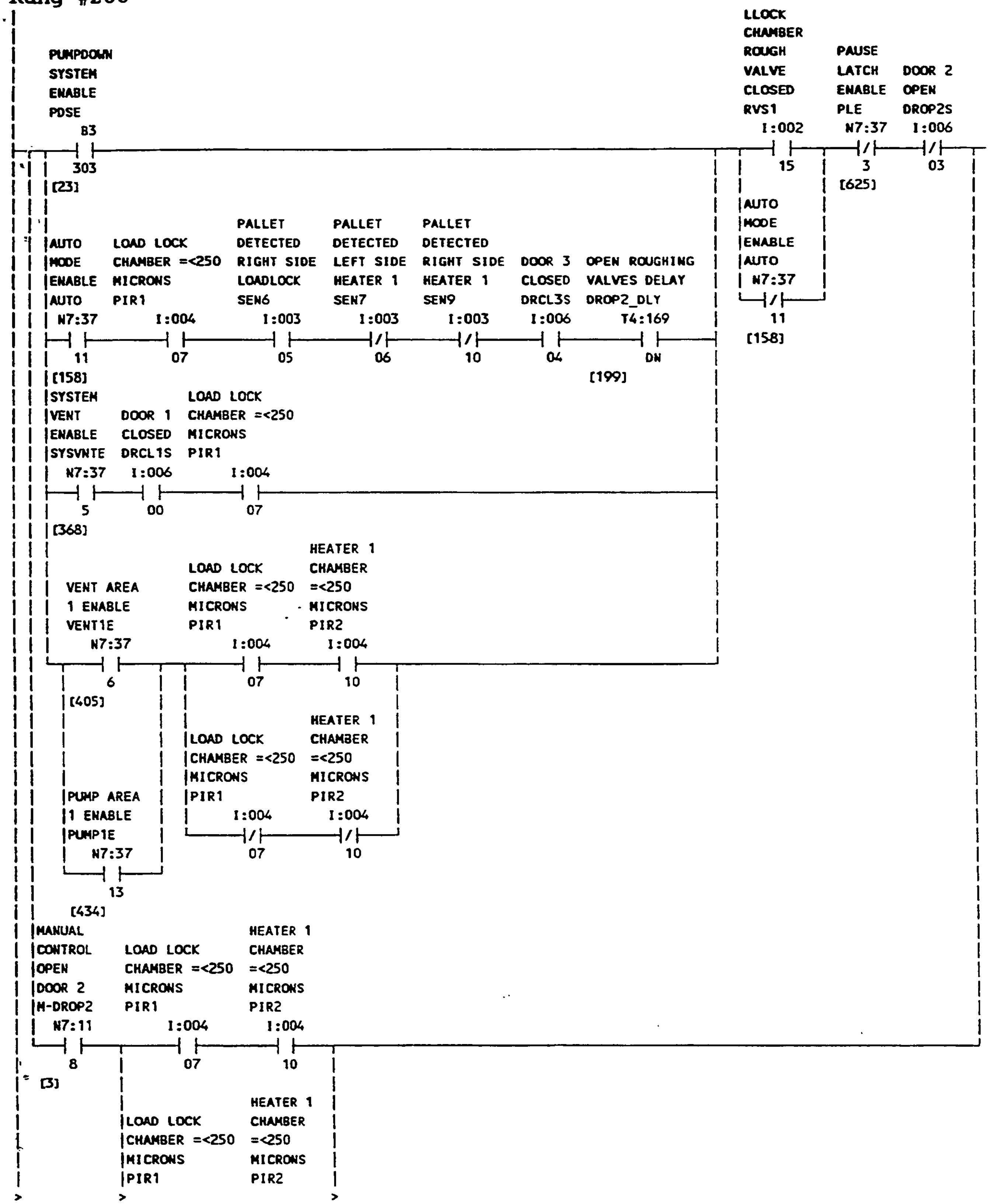
PALLET DETECTED LEFT SIDE HEATER 1 SEN7 I:003

```
                         06
O:013/04 - -|/|- - File #2 MAIN_PRGRM -  198
           -( )- - File #2 MAIN_PRGRM -  197
T4:245.TT - -| |- - File #2 MAIN_PRGRM -  194
Rung #198
|                                                    MOTOR 5
|MOTOR 5                                             SLOW STOP
|SLOW                                                PULSE
|M5S                                                 M5SSP
| O:013                                              --TON--------------
|--|/|-----------------------------------------------TIMER ON DELAY  -(EN)-
    04                                               |TIMER:     T4:265|
|[197]                                               |BASE (SEC):  0.01|-(DN)
|                                                    |PRESET:       100|
|                                                    |ACCUM:        102|

T4:265.TT - -| |- - File #2 MAIN_PRGRM -  194
Rung #199
|LLOCK
|CHAMBER
|ROUGH    AUTO
|VALVE    MODE                                       DOOR 2 OPEN
|CLOSED   ENABLE                                     DELAY
|RVS1     AUTO                                       DROP2_DLY
  I:002   N7:37                                      --TON--------------
|--| |-----| |---------------------------------------TIMER ON DELAY  -(EN)-
    15     11                                        TIMER:      T4:169
          [158]                                      BASE (SEC):  1.0-(DN)
                                                     PRESET:         2
                                                     ACCUM:          2

T4:169.DN - -| |- - File #2 MAIN_PRGRM -  104,200
```

Rung #200


PUMPDOWN SYSTEM ENABLE PDSE
B3
303
[23]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
I:002
15
PAUSE LATCH ENABLE PLE
N7:37
3
[625]
DOOR 2 OPEN DROP2S
I:006
03
AUTO MODE ENABLE AUTO
N7:37
11
[158]
AUTO MODE ENABLE AUTO
N7:37
11
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
PALLET DETECTED LEFT SIDE HEATER 1 SEN7
I:003
06
PALLET DETECTED RIGHT SIDE HEATER 1 SEN9
I:003
10
DOOR 3 CLOSED DRCL3S
I:006
04
OPEN ROUGHING VALVES DELAY DROP2_DLY
T4:169
DN
[158]
[199]
SYSTEM VENT ENABLE SYSVNTE
N7:37
5
DOOR 1 CLOSED DRCL1S
I:006
00
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
[368]
VENT AREA 1 ENABLE VENT1E
N7:37
6
[405]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
PUMP AREA 1 ENABLE PUMP1E
N7:37
13
[434]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
MANUAL CONTROL OPEN DOOR 2 M-DROP2
N7:11
8
[3]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
LOAD LOCK CHAMBER =<250 MICRONS PIR1
HEATER 1 CHAMBER =<250 MICRONS PIR2

```
        1:004       1:004
   -----|/|---------|/|---
        07          10

OPEN DOOR
SOLENOID
2 ENABLE
DROP2
   O:011
----( )----------------
    03
|MANUAL
|CONTROL  OPEN DOOR   MANUAL
|OPEN     SOLENOID    DOOR 2
|DOOR 2   2 ENABLE    OPEN
|M-DROP2  DROP2       MDR2OP
| N7:11     O:011      N7:32
|---| |-------] [------+--(L)----
     8        03       |   8
 [3]       [200]       |
                       |MANUAL
                       |DOOR 2
                       |CLOSE
                       |MDR2CL
                       | N7:31
                       +--(U)----
                           12
```

```
O:011/03 - - - - File #2 MAIN_PRGRM -  200
                 File #5 FAULTS -  43
                 File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  200
N7:32/8 - -(L)- - File #2 MAIN_PRGRM -  200
         -(U)- - File #2 MAIN_PRGRM -  202
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2
N7:31/12 - -(L)- - File #2 MAIN_PRGRM -  202
         -(U)- - File #2 MAIN_PRGRM -  200
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #201

```
|PALLET    PALLET      PALLET                          PALLET AT
|DETECTED  DETECTED    DETECTED                        DOOR 2
|CENTER    RIGHT SIDE  LEFT SIDE                       PLT_DR2
|LOADLOCK  LOADLOCK    HEATER 1                          63
|SEN5      SEN6        SEN7
| 1:003     1:003       1:003
|--] [------] [---------] [-------------------------------( )----
    04        05          06                              200
B3/200 - -|/|- - File #2 MAIN_PRGRM -  202
       -( )- - File #2 MAIN_PRGRM -  201
```

Rung #202

```
         PALLET                     PALLET      PALLET       PALLET      PALLET
AUTO     DETECTED                   DETECTED    DETECTED     DETECTED    DETECTED                 DOOR CLOSE
MODE     RIGHT SIDE     DOOR 3      LEFT SIDE   RIGHT SIDE   LEFT SIDE   RIGHT SIDE   DOOR 2      SOLENOID
ENABLE   HEATER 1       CLOSED      LOADLOCK    LOADLOCK     HEATER 1    HEATER 1     CLOSED      2 ENABLE
AUTO     SEN9           DRCL3S      SEN4        SEN6         SEN7        SEN9         DRCL2S      DRCL2
N7:37    I:003          I:006       I:003       I:003        I:003       I:003        I:006       O:011
                                                                                      --|/|--     --( )--
11       10             04          03          05           06          10           02          02

[158]                               PALLET      PALLET       PALLET      PALLET                   MANUAL
                                    DETECTED    DETECTED     DETECTED    DETECTED                 DOOR 2
                                    LEFT SIDE   RIGHT SIDE   LEFT SIDE   RIGHT SIDE               OPEN
                                    LOADLOCK    LOADLOCK     HEATER 1    HEATER 1                 MDR2OP
PREPARE FOR                         SEN4        SEN6         SEN7        SEN9                     N7:32
AUTO RUN                            I:003       I:003        I:003       I:003                    --(U)--
>AUTO                               --|/|--     --|/|--      --|/|--     --|/|--                  8
N7:37                               03          05           06          10

[162]                                                                                             MANUAL
                                                                                                  DOOR 2
                                                                                                  CLOSE
                                                                                                  MDR2CL
                                                                                                  N7:31
VENT                                                                                              --(L)--
LOAD LOCK                                                                                         12
VNT_LL
N7:24

13
[674]
PUMPDOWN
LOADLOCK
CLEAN
CYCLE
PD-LL-CC
B3

144
[678]
MANUAL CONTROL   PALLET AT
CLOSE DOOR 2     DOOR 2
M-DRCL2          PLT_DR2
N7:10            B3
                 --|/|--
12               200
[3]              [201]
```

```
O:011/02 - - - - File #5 FAULTS - 19
                 File #6 TECH_RUNGS - 2
         -( )- - File #2 MAIN_PRGRM - 202
N7:32/8 - -(L)- - File #2 MAIN_PRGRM - 200
         -(U)- - File #2 MAIN_PRGRM - 202
_F:N7:21[%2' - BTW - File #2 MAIN_PRGRM - 2
N7:31/12 - -(L)- - File #2 MAIN_PRGRM - 202
         -(U)- - File #2 MAIN_PRGRM - 200
_F:N7:21[%2' - BTW - File #2 MAIN_PRGRM - 2
```

```
Rung #203
|DOOR OPEN
|SOLENOID                                                         TEST COUNTER
|3 ENABLE                                                         TST_CNTR
|DROP3                                                            +-CTU--------+
   O:011                                                          |COUNT UP    |-(CU)-
|--] [------------------------------------------------------------|COUNTER: C5:0|
     05                                                           |PRESET:     |-(DN)
|[216]                                                            |ACCUM:   98 |

C5:0 - CTU - File #2 MAIN_PRGRM - 203
       RES - File #2 MAIN_PRGRM - 212
Rung #204
|          PALLET
|AUTO      DETECTED
|MODE      RIGHT SIDE                                                  SENSOR 9
|ENABLE    HEATER 1                                                    LATCH
|AUTO      SEN9                                                        SEN9_LTCH
| N7:37     I:003                                                      B3
|--] [-------] [-------------------------------------------------------(L)-
|  11        10                                                        329
|[158]
B3/329 - ] [ - File #2 MAIN_PRGRM - 206
       -(L)- - File #2 MAIN_PRGRM - 204
       -(U)- - File #2 MAIN_PRGRM - 205
Rung #205
|          PALLET      PALLET
|AUTO      DETECTED    DETECTED
|MODE      RIGHT SIDE  LEFT SIDE                                       SENSOR 9
|ENABLE    HEATER 2    DWELL 1                                         LATCH
|AUTO      SEN12       SEN13                                           SEN9_LTCH
| N7:37     I:003       I:003                                          B3
|--] [-------]/[---------] [-------------------------------------------(U)-
|  11        13          14                                            329
|[158]
B3/329 - ] [ - File #2 MAIN_PRGRM - 206
       -(L)- - File #2 MAIN_PRGRM - 204
       -(U)- - File #2 MAIN_PRGRM - 205
Rung #206
|AUTO                                                             CHART RECORDER
|MODE      SENSOR 9                                               COUNTER 1
|ENABLE    LATCH                                                  CHRTCNTR1
|AUTO      SEN9_LTCH                                              +-CTU--------+
| N7:37     B3                                                    |COUNT UP    |-(CU)-
|--] [-------] [--------------------------------------------------|COUNTER: C5:29|
|  11        329                                                  |PRESET:     |-(DN)
|[158]     [205]                                                  |ACCUM:   98 |
|
|
C5:29 - CTU - File #2 MAIN_PRGRM - 206
        RES - File #2 MAIN_PRGRM - 212
C5:29.ACC - NEQ - File #2 MAIN_PRGRM - 210
Rung #207
|          PALLET      PALLET
|AUTO      DETECTED    DETECTED
|MODE      CENTER      RIGHT SIDE                                      SENSOR 42
|ENABLE    CARBON      CARBON                                          LATCH
|AUTO      SEN41       SEN42                                           SEN42_LTCH
| N7:37     I:053       I:053                                          B3
|--] [-------]/[---------] [-------------------------------------------(L)-
|  11        01          02                                            330
|[158]
```

239

```
B3/330 - -] [- - File #2 MAIN_PRGRM    .09
        -(L)- - File #2 MAIN_PRGRM -  207
        -(U)- - File #2 MAIN_PRGRM -  208
Rung #208
:        PALLET    PALLET
|AUTO    DETECTED  DETECTED
|MODE    CENTER    RIGHT SIDE                                            SENSOR 42
,ENABLE  DWELL 6   DWELL 6                                               LATCH
|AUTO    SEN44     SEN45                                                 SEN42_LTCH
 N7:37    I:053     I:053                                                   B3
--] [------] [------] [-------------------------------------------------(U)---
   11       04        05                                                   330
 [158]
B3/330 - -] [- - File #2 MAIN_PRGRM -  209
        -(L)- - File #2 MAIN_PRGRM -  207
        -(U)- - File #2 MAIN_PRGRM -  208
Rung #209
|AUTO
|MODE    SENSOR 42                                            CHART RECORDER
|ENABLE  LATCH                                                COUNTER 2
|AUTO    SEN42_LTCH                                           CHRTCNTR2
 N7:37      B3                                                --CTU------------
--] [------] [------------------------------------------------COUNT UP     -(CU)-
   11       330                                               |COUNTER:  C5:30|
 [158]    [208]                                                PRESET:      0-(DN)
                                                               ACCUM:       96

C5:30 - CTU - File #2 MAIN_PRGRM -  209
        RES - File #2 MAIN_PRGRM -  212
C5:30.ACC - NEQ - File #2 MAIN_PRGRM -  210
Rung #210
                                                                CHART RECORDER
                                                                1 ON
|CHRTCNTR1                                                      CHRTRCD1
|--NEQ-----------------                                            O:044
|NOT EQUAL (A<>B)      ---------------------------------------------( )------
||SOURCE A:   C5:29.ACC|                                            00
||                   98|
||SOURCE B:   C5:30.ACC|
|                    96|
 ----------------------
|C5:29.ACC - [212]                                              |CHART RECORDER
|C5:30.ACC - [209]                                               2 ON
                                                                |CHRTRCD2
                                                                   O:044
                                                                ------( )------
                                                                     01

Rung #211
                            PALLET
|AUTO                       DETECTED
|MODE    DOOR 2    DOOR 3   RIGHT SIDE                         HEATER1
|ENABLE  CLOSED    CLOSED   HEATER 1                           TIMER
|AUTO    DRCL2S    DRCL3S   SEN9                               HTR1TMR
 N7:37    I:006     I:006     I:003                            --TON-----------
--] [------] [------] [-------] [-------------------------------TIMER ON DELAY  -(EN)-
   11       02        04        10                             |TIMER:     T4:74|
 [158]                                                         |BASE (SEC):  1.0-(DN)
                                                               |PRESET:       60|
                                                               |ACCUM:         0|

T4:74.DN - ] [ - File #2 MAIN_PRGRM -  214,226
T4:74.TT - ]/[ - File #2 MAIN_PRGRM -  213
```

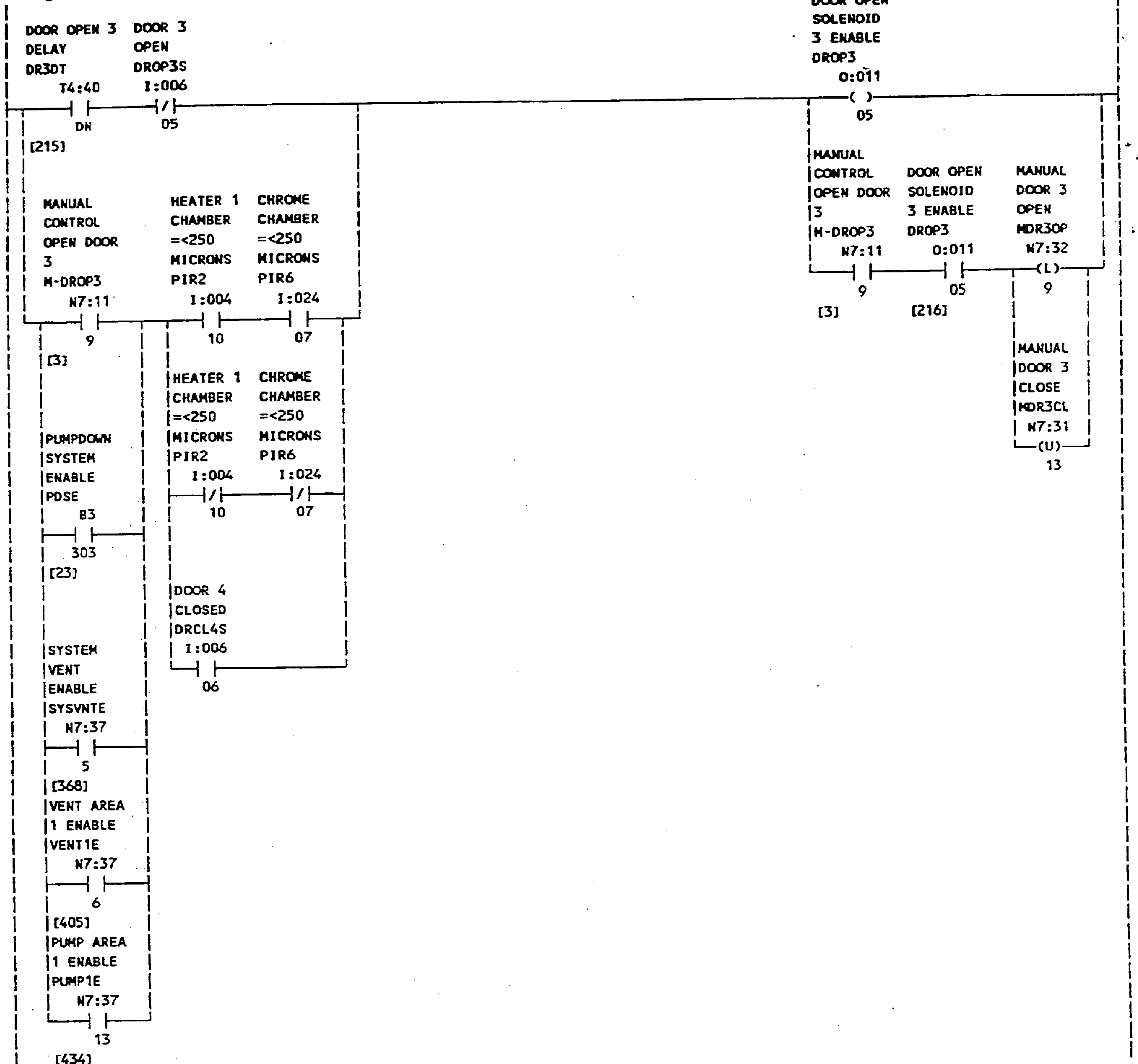
```
Rung #212
|AUTO
|MODE
|ENABLE                                                              TEST COUNTER
|AUTO                                                                TST_CNTR
| N7:37                                                                  C5:0
|--|/|-------------------------------------------------------------------(RES)---|
|   11
|[158]
| C5:0 - CTU - File #2 MAIN_PRGRM - 203                             |CHART RECORDER
| C5:29 - CTU - File #2 MAIN_PRGRM - 206                            |COUNTER 1
| C5:29.ACC - NEQ - File #2 MAIN_PRGRM - 210                        |CHRTCNTR1
| C5:30 - CTU - File #2 MAIN_PRGRM - 209                            |     C5:29
| C5:30.ACC - NEQ - File #2 MAIN_PRGRM - 210                        |-----(RES)----|
|                                                                   |CHART RECORDER
|                                                                   |COUNTER 2
|                                                                   |CHRTCNTR2
|                                                                   |     C5:30
|                                                                   |-----(RES)----|

Rung #213
|          HEATER
|          SHIELD H2C                                                 SUBSTRATE
|          FLOW                                                       HEATER
|HEATER 1  GROUP 1                                                    SET HIGH
|TIMER     FAULT                                                      HH1A
|HTR1TMR   HSFG1F                                                      O:046
|  T4:74        B3
|---| |--------|/|-----------------------------------------------------( )-----|
|    TT        216                                                     00
|[211]      [5:190]                                                 |SUBSTRATE
| O:046/00 - -|/|- - File #2 MAIN_PRGRM - 153                       |HEATER
| O:046/01 - -|/|- - File #2 MAIN_PRGRM - 153                       |SET HIGH
| O:046/05 - -|/|- - File #2 MAIN_PRGRM - 153                       |HH1B
| O:046/06 - -|/|- - File #2 MAIN_PRGRM - 153                       |  O:046
|                                                                   |----( )----|
|                                                                   |    01
|                                                                   |SUBSTRATE
|                                                                   |HEATER
|                                                                   |SET HIGH
|                                                                   |HH3A
|                                                                   |  O:046
|                                                                   |----( )----|
|                                                                        05
|                                                                   |SUBSTRATE
|                                                                   |HEATER
|                                                                   |SET HIGH
|                                                                   |HH3B
|                                                                   |  O:046
|                                                                   |----( )----|
|                                                                        06
```

```
Rung #214
|                       PALLET
|AUTO                   DETECTED                                                          HEATER
|MODE     HEATER 1      RIGHT SIDE                                                        DELAY
|ENABLE   COMPLETE      DWELL 1                                                           TIMER
|AUTO     HTR1TMR       SEN15                                                             HTRDLYTMR
| W7:37    T4:74         I:003                                                            --TON--------------
|--] [------] [----------]/[-------------------------------------------------------------|TIMER ON DELAY  |-(EN)-
|   11       DN          16                                                               |TIMER:     T4:75|
|[158]     [211]                                                                          |BASE (SEC): 1.0|-(DN)
                                                                                          |PRESET:       25|
                                                                                          |ACCUM:         0|
                                                                                          -------------------

T4:75.DN - -- ] [- - File #2 MAIN_PRGRM -  215
Rung #215
|                                                            HEATER 1
|                                                            HIVAC BAFFLE
|HTRDLYTMR                                                   HV1_2
|  T4:75                                                        O:011
|---] [-------------------------------------------------------------(L)-----------------------
|   DN                                                             12
|[214]
| O:011/12 - -- ] [- - File #2 MAIN_PRGRM - 379               PAUSE
|            --]/[- - File #2 MAIN_PRGRM - 38                 LATCH                DOOR 3
|            -(U)-  - File #2 MAIN_PRGRM - 116                ENABLE               DELAY TIMER
|  T4:40.DN - --  -- - File #2 MAIN_PRGRM - 216               PLE                  DR3DT
|                                                              W7:37               --TON-------------
|                                                           ------]/[--------------|TIMER ON DELAY  -(EN)-
|                                                                  3               |TIMER:     T4:40|
|                                                             [625]                |BASE (SEC): 1.0|-(DN)
|                                                                                  |PRESET:       5|
|                                                                                  |ACCUM:        0|
|                                                             |PALLLET   PALLET     -----------------
|                                                             |DETECTED  DETECTED
|                                                             |CENTER    RIGHT SIDE
|                                                             |DWELL 1   DWELL 1
|                                                             |SEN14     SEN15
|                                                             |  I:003     I:003
|                                                             |---]/[------]/[---
|                                                                 15        16
```

Rung #216



O:011/05 - -| |- - File #2 MAIN_PRGRM - 203
File #5 FAULTS - 45
File #6 TECH_RUNGS - 2
-( )- - File #2 MAIN_PRGRM - 216
N7:32/9 - -(L)- - File #2 MAIN_PRGRM - 216
-(U)- - File #2 MAIN_PRGRM - 229

243

```
_F:N7:211X21 - BTW - File #2 MAIN_PRt    - 2
N7:31/13 - -(L)- - File #2 MAIN_PRGRM -  229
           -(U)- - File #2 MAIN_PRGRM -  216
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
```

Rung #217

```
| MOTOR 6       MOTOR DRIVE                               MOTOR 6
  FAST PULSE    PULSER                                    INTERRUPT
  M6FP          MDP                                       M6I
    T4:206        B3                                        O:012
---+---] [---+----] [-------------------------------------( )---
   |    TT   |   299                                         05
   | [218]   | [14]
   | MOTOR 6 |
   | FAST STOP
   | PULSE   |
   | M6FSP   |
   |  T4:226 |
   +---] [---+
   |    TT   |
   | [219]   |
   | MOTOR 6 |
   | SLOW PULSE
   | M6SP    |
   |  T4:246 |
   +---] [---+
   |    TT   |
   | [220]   |
   | MOTOR 6 |
   | SLOW STOP
   | PULSE   |
   | M6SSP   |
   |  T4:266 |
   +---] [---+
        TT
    [221]
```

244

Rung #218

```
                                      PALLET         PALLET
  AUTO                                DETECTED       DETECTED
  MODE     DOOR 4      DOOR 3         RIGHT SIDE     RIGHT SIDE     STOP MOTOR 6      MOTOR 6        MOTOR 6
  ENABLE   OPEN        OPEN           HEATER 1       HEATER 2       PAUSE LATCH       REVERSE        FAST
  AUTO     DROP4S      DROP3S         SEN9           SEN12          M6PL              M6R            M6F
  N7:37    I:006       I:006          I:003          I:003             B3              B3            O:012
--] [------] [--------] [-----------] [-------------]/[---------------]/[---------------]/[------------( )--
   11       07          05             10             13               474             106            15
 [158]                                                               [629]           [573]
                                      PALLET
                                      DETECTED
                                      LEFT SIDE                      PALLLET   PALLET               MOTOR 6
                                      HEATER 2                       DETECTED  DETECTED             FAST PULSE
                                      SEN10                          CENTER    RIGHT SIDE           M6FP
                                        I:003                        DWELL 1   DWELL 1              --TON---------------
                                      --] [--                        SEN14     SEN15                TIMER ON DELAY   -(EN)-
                                         11                           I:003     I:003               TIMER:      T4:206
                                                                     --]/[------]/[--               BASE (SEC):   0.01 -(DN)
                           PALLET       PALLET                         15        16                 PRESET:        100
                           DETECTED     DETECTED                                                    ACCUM:           0
                           RIGHT SIDE   RIGHT SIDE
                           HEATER 2     DWELL 1
                           SEN12        SEN15
                            I:003        I:003
                         ---] [----------]/[---
                             13           16
                           PALLET
                           DETECTED
                           CENTER
                           BUFFER 1
                           SEN11
                            I:003
                           --] [--
                             12
  MANUAL MOTOR      DOOR 4
  6 ON              OPEN
  MM6ON             DROP4S
    N7:23            I:006
  ---] [-------------] [-----
      4               07
  [516]
                    PALLET
                    DETECTED
                    RIGHT SIDE
                    HEATER 2
                    SEN12
                     I:003
                    --]/[--
                      13
O:012/15 - -] [- - File #5 FAULTS -  3
           -]/[- - File #2 MAIN_PRGRM -  219
           -( )- - File #2 MAIN_PRGRM -  218
T4:206.TT - -] [- - File #2 MAIN_PRGRM -  217
```

Rung #219

```
|                                                         MOTOR 6          |
|MOTOR 6                                                  FAST STOP        |
|FAST                                                     PULSE            |
|M6F                                                      M6FSP            |
| O:012                                                   +--TON---------+ |
+--|/|----------------------------------------------------+TIMER ON DELAY+-(EN)-+
|  15                                                     |TIMER:  T4:226| |
|[218]                                                    |BASE (SEC): 0.01+-(DN)|
|                                                         |PRESET:    100| |
|                                                         |ACCUM:     102| |
|                                                         +--------------+ |
T4:226.TT - -| |- - File #2 MAIN_PRGRM - 217
```

Rung #220

```
| MANUAL MOTOR  DOOR 4                                  MOTOR 6              |
| 6 ON          OPEN                                    SLOW                 |
| MM6ON         DROP4S                                  M6S                  |
|    N7:23       I:006                                   O:013               |
+-+----| |-------| |-----+-+----------------------------+---( )-------------+-+
| |       4       07     | |                            |    05             | |
| |[516]         |       | |                            |                   | |
| |              |PALLET | | O:013/05 - -|/|- - File #2 MAIN_PRGRM - 221     | |
| |              |DETECTED | T4:246.TT - -| |- - File #2 MAIN_PRGRM - 217    | |
| |              |RIGHT SIDE|                           |MOTOR 6            | |
| |              |HEATER 2 |                            |SLOW PULSE         | |
| |              |SEN12  | |                            |M6SP               | |
| |              |  I:003| |                            | +--TON---------+  | |
| |              +--|/|--+ |                            +-+TIMER ON DELAY+-(EN)-+
| |                  13    |                              |TIMER:  T4:246|    |
| |                        |                              |BASE (SEC): 0.01+-(DN)
| |                        |                              |PRESET:    100|    |
| |MOTOR 6   DOOR 3        |                              |ACCUM:       0|    |
| |REVERSE   OPEN          |                              +--------------+    |
| |M6R       DROP3S        |                                                  |
| |  B3       I:006        |                                                  |
| +--| |---+---| |----+----+                                                  |
|     106  |   05     |                                                       |
| [573]    |          |                                                       |
|          |PALLET    |                                                       |
|          |DETECTED  |                                                       |
|          |LEFT SIDE |                                                       |
|          |HEATER 2  |                                                       |
|          |SEN10     |                                                       |
|          |  I:003   |                                                       |
|          +---|/|----+                                                       |
|               11                                                            |
```

Rung #221

```
|                                                         MOTOR 6          |
|MOTOR 6                                                  SLOW STOP        |
|SLOW                                                     PULSE            |
|M6S                                                      M6SSP            |
| O:013                                                   +--TON---------+ |
+--|/|----------------------------------------------------+TIMER ON DELAY+-(EN)-+
|  05                                                     |TIMER:  T4:266| |
|[220]                                                    |BASE (SEC): 0.01+-(DN)|
|                                                         |PRESET:    100| |
|                                                         |ACCUM:     102| |
|                                                         +--------------+ |
T4:266.TT - -| |- - File #2 MAIN_PRGRM - 217
```

```
Rung #222
|            PALLET                                                  HEATER 2
|AUTO        DETECTED                                                DELAY OFF
|MODE        LEFT SIDE                                               TIMER
|ENABLE      DWELL 1                                                 HTR2_OFF
|AUTO        SEN13                                                   +--TON-----------+
| N7:37       I:003                                                  |                |
|---] [-------] [-----------------------------------------------------+TIMER ON DELAY  +-(EN)-
|    11   |    14    |                                               |TIMER:     T4:76|
|[158]    |          |                                               |BASE (SEC):  1.0+-(DN)
|         |PALLLET   | T4:76.DN - ] [ - File #2 MAIN_PRGRM - 223     |PRESET:       13|
|         |DETECTED  |                                               |ACCUM:        13|
|         |CENTER    |                                               +----------------+
|         |DWELL 1   |
|         |SEN14     |
|         |  I:003   |
|         |---] [----|
|         |    15    |
|         |PALLET    |
|         |DETECTED  |
|         |RIGHT SIDE|
|         |DWELL 1   |
|         |SEN15     |
|         |   I:003  |
|         +---] [----+
|              16
Rung #223
|                                                                    HEATER 2
|                                                                    LATCH
| HTR2_OFF                                                           HTR2LTCH
|  T4:76                                                                B3
|---] [---------------------------------------------------------------(U)----
| |   DN           |                                                   320
| |[222]           |
| |                | B3/320 - ] [ - File #2 MAIN_PRGRM - 225, 227
| |                |        -(L)- - File #2 MAIN_PRGRM - 224
| |HSFFTMR         |
| |  T4:93         |
| |---] [----------|
| |   DN           |
| |[S:199]         |
| |AUTO OFF        |
| |PULSE           |
| |AUOFPULSE       |
| |  T4:283        |
| |---] [----------|
| |   TT           |
| |[155]           |
| |PALLET          |
| |DETECTED        |
| |RIGHT SIDE  HEATER LATCH |
| |DWELL 1     UNLATCH      |
| |SEN15       HTR_UNLTCH   |
| |  I:003        B3        |
| +---] [--------[ONS]------+
|      16         411
```

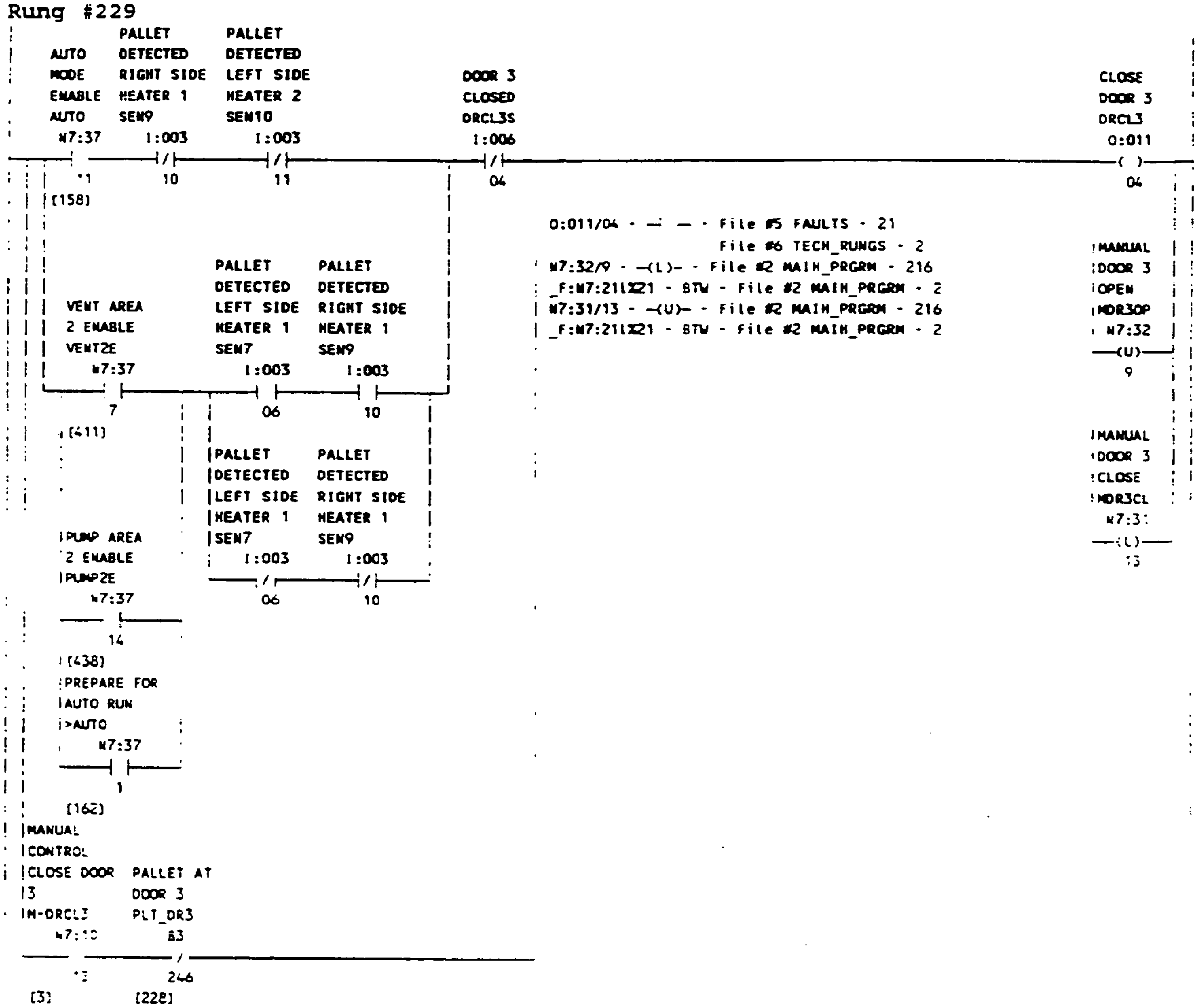
```
Rung #224
|                                                              HEATER 2  |
|                                                              LATCH     |
|HTR2ON_DY                                                     HTR2LTCH  |
|  T4:78                                                          B3     |
|---] [--------------------------------------------------------(L)-------|
|    DN                                                          320     |
|[226]                                                                   |
B3/320 - ] [ - File #2 MAIN_PRGRM -  225,227
        -(L)- - File #2 MAIN_PRGRM -  224
        -(U)- - File #2 MAIN_PRGRM -  223
Rung #225
|HEATER 2                                     HEATER 2 DRIVE             |
|LATCH                                        FAULT TIMER                |
|HTR2LTCH                                     H2F                        |
|   B3                                        +-TON-----------+          |
|---] [---------------------------------------|TIMER ON DELAY |-(EN)-----|
|  320                                        |TIMER:     T4:6|          |
|[224]                                        |BASE (SEC): 1.0|-(DN)     |
|                                             |PRESET:      70|          |
|                                             |ACCUM:        0|          |
|                                             +---------------+          |
T4:6.DN - ]/[ - File #2 MAIN_PRGRM -  227
Rung #226
|                 HEATER                                                 |
|                 SHIELD H2O                                             |
|AUTO             FLOW                                                   |
|MODE    HEATER 1 GROUP 2                     heater 2 on                |
|ENABLE  COMPLETE FAULT                       delay                      |
|AUTO    HTR1TMR  HSFG2F                      HTR2ON_DY                  |
| N7:37   T4:74      B3                       +-TON-----------+          |
|---] [-----] [------]/[----------------------|TIMER ON DELAY |-(EN)-----|
|   11     DN       217                       |TIMER:    T4:78|          |
|[158]   [211]    [5:191]                     |BASE (SEC): 1.0|-(DN)     |
|                                             |PRESET:      26|          |
|                                             |ACCUM:        0|          |
|                                             +---------------+          |
T4:78.DN - ] [ - File #2 MAIN_PRGRM -  224
```

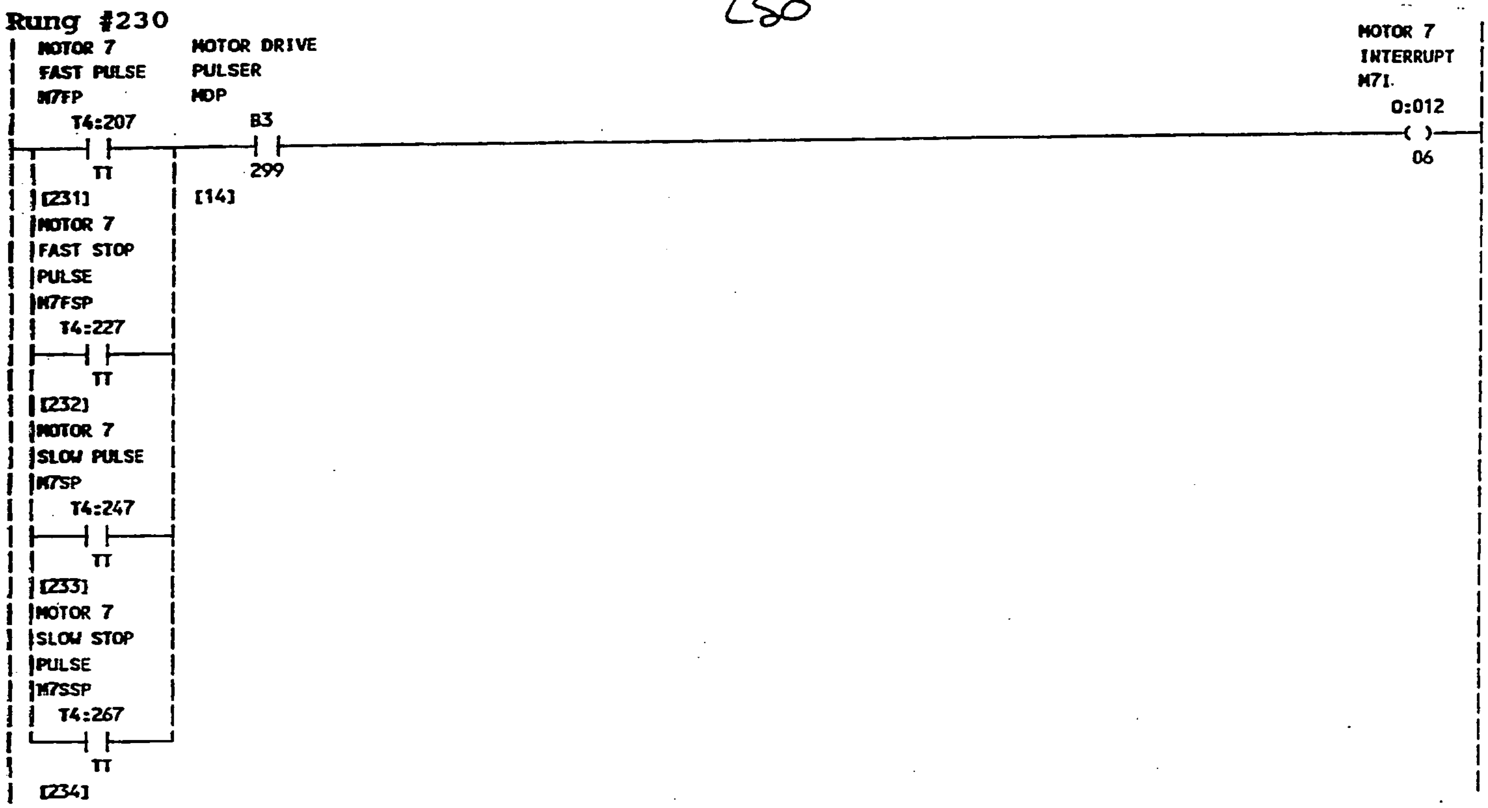
248

```
Rung #227
                                                              SUBSTRATE
HEATER 2  HEATER 2 DRIVE                                      HEATER
LATCH     FAULT TIMER                                         SET HIGH
HTR2LTCH  H2F                                                 HH2A
  B3        T4:6                                                O:046
--] [--------]/[----------------------------------------------( )--
  320       DN                                                  02
[224]     [225]
 O:046/02 - ]/[ - File #2 MAIN_PRGRM - 153                    SUBSTRATE
 O:046/03 - ]/[ - File #2 MAIN_PRGRM - 153                    HEATER
 O:046/04 - ]/[ - File #2 MAIN_PRGRM - 153                    SET HIGH
 O:046/07 - ]/[ - File #2 MAIN_PRGRM - 153                    HH2B
                                                                O:046
                                                              --( )--
                                                                03
                                                              SUBSTRATE
                                                              HEATER
                                                              SET HIGH
                                                              HH2C
                                                                O:046
                                                              --( )--
                                                                04
                                                              SUBSTRATE
                                                              HEATER
                                                              SET HIGH
                                                              HH3C
                                                                O:046
                                                              --( )--
                                                                07

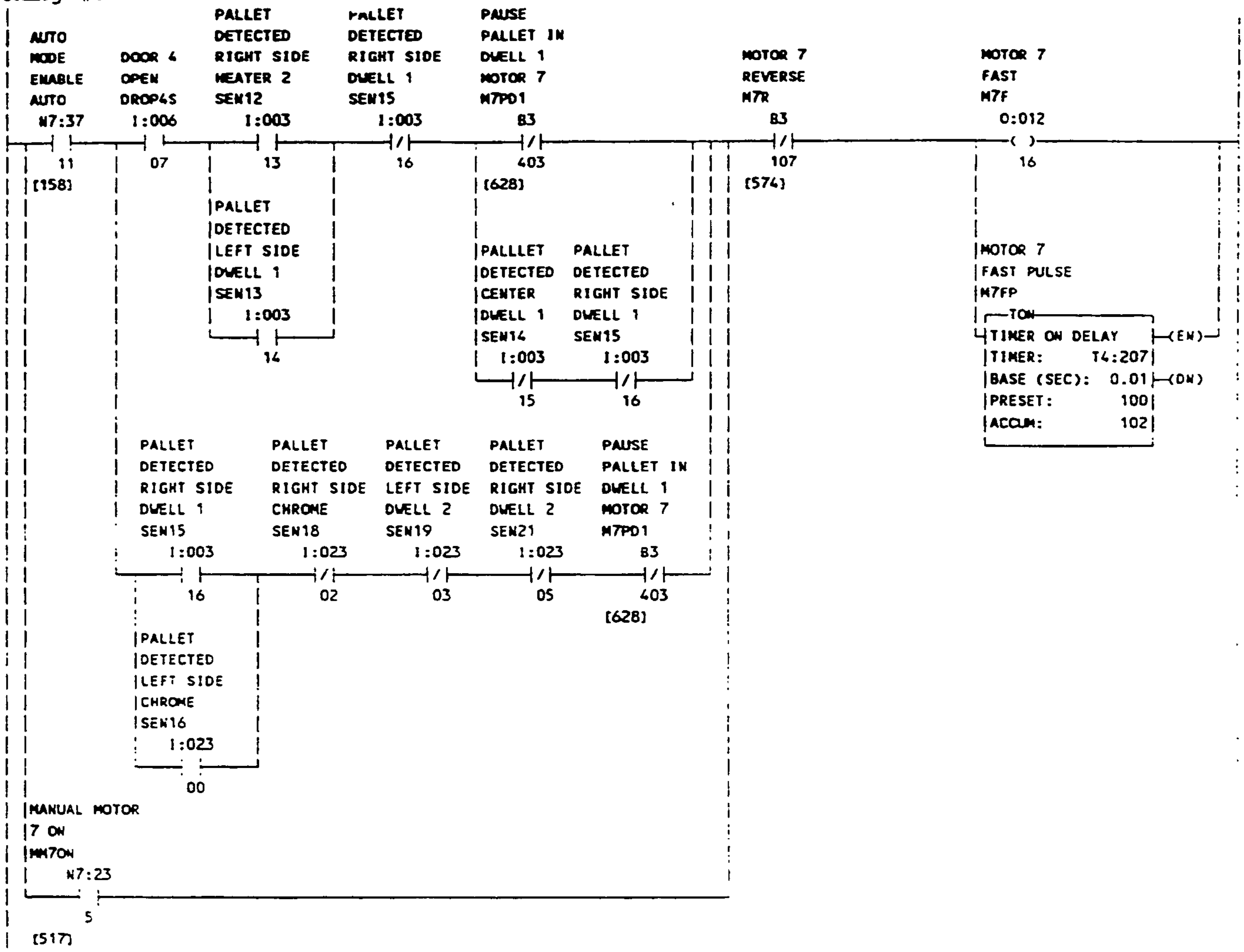
Rung #228
 PALLET       PALLET      PALLET
 DETECTED     DETECTED    DETECTED
 CENTER       RIGHT SIDE  LEFT SIDE                           PALLET AT
 HEATER 1     HEATER 1    HEATER 2                            DOOR 3
 SEN8         SEN9        SEN10                               PLT_DR3
   I:003        I:003       I:003                               B3
-+--] [--+------] [---------] [-------------------------------( )--
 |   07  |      10          11                                  246
 |PALLET |    B3/246 - ]/[ - File #2 MAIN_PRGRM - 229
 |DETECTED
 |RIGHT SIDE
 |HEATER 2
 |SEN12  |
 |  I:003|
 +--] [--+
     13
```

Rung #229


AUTO MODE ENABLE AUTO
N7:37
1
[158]
PALLET DETECTED RIGHT SIDE HEATER 1 SEN9
I:003
10
PALLET DETECTED LEFT SIDE HEATER 2 SEN10
I:003
11
DOOR 3 CLOSED DRCL3S
I:006
04
CLOSE DOOR 3 DRCL3
O:011
04
O:011/04 - - File #5 FAULTS - 21
File #6 TECH_RUNGS - 2
N7:32/9 - -(L)- - File #2 MAIN_PRGRM - 216
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
N7:31/13 - -(U)- - File #2 MAIN_PRGRM - 216
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
MANUAL DOOR 3 OPEN MDR3OP
N7:32
9
MANUAL DOOR 3 CLOSE MDR3CL
N7:31
13
VENT AREA 2 ENABLE VENT2E
N7:37
7
[411]
PALLET DETECTED LEFT SIDE HEATER 1 SEN7
I:003
06
PALLET DETECTED RIGHT SIDE HEATER 1 SEN9
I:003
10
PUMP AREA 2 ENABLE PUMP2E
N7:37
14
[438]
PREPARE FOR AUTO RUN >AUTO
N7:37
1
[162]
MANUAL CONTROL CLOSE DOOR 3 M-DRCL3
N7:10
13
[3]
PALLET AT DOOR 3 PLT_DR3
B3
246
[228]


Rung #230
MOTOR 7
FAST PULSE
M7FP
T4:207
TT
[231]
MOTOR DRIVE
PULSER
MDP
B3
299
[14]
MOTOR 7
FAST STOP
PULSE
M7FSP
T4:227
TT
[232]
MOTOR 7
SLOW PULSE
M7SP
T4:247
TT
[233]
MOTOR 7
SLOW STOP
PULSE
M7SSP
T4:267
TT
[234]
MOTOR 7
INTERRUPT
M7I
O:012
06

Rung #231

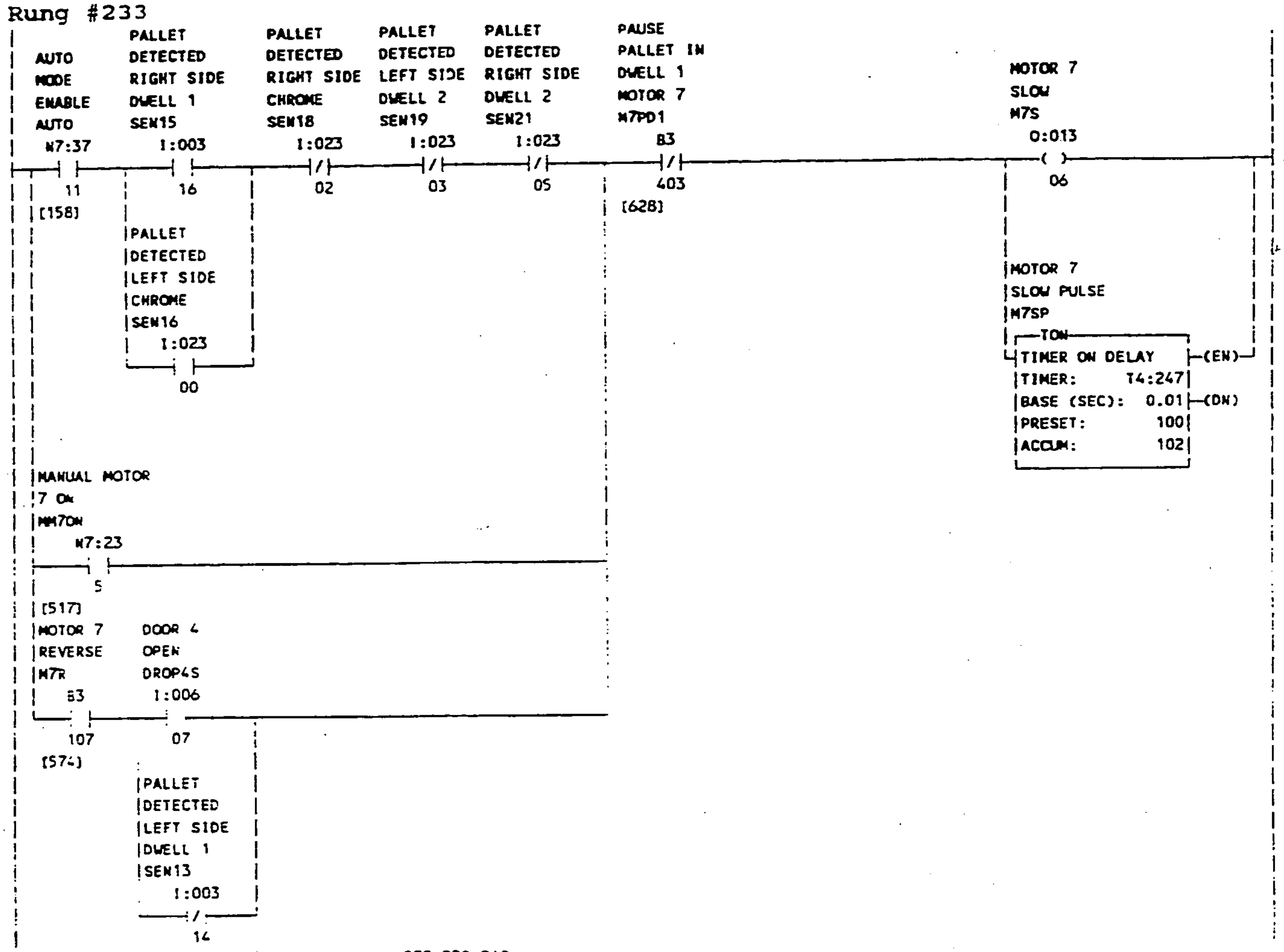


O:012/16 - ⊣ ⊢ - File #5 FAULTS - 3
⊣/⊢ - File #2 MAIN_PRGRM - 232
-( )- - File #2 MAIN_PRGRM - 231
T4:207.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 230

Rung #232

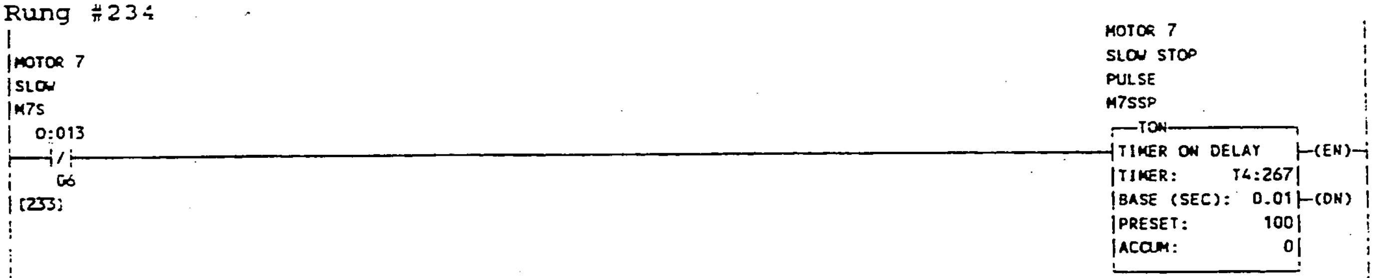
T4:227.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 230

Rung #233



O:013/06 - —] [- - File #2 MAIN_PRGRM - 235,238,249
—]/[- - File #2 MAIN_PRGRM - 234
—( )- - File #2 MAIN_PRGRM - 233
T4:247.TT - —] [- - File #2 MAIN_PRGRM - 230

Rung #234



T4:267.TT - —] [- - File #2 MAIN_PRGRM - 230

253

```
Rung #235
|                PALLLET   PALLET     PALLET                                   CHROME HI    |
|AUTO            DETECTED  DETECTED   DETECTED                                 POWER        |
|MODE    MOTOR 7 CENTER    RIGHT SIDE LEFT SIDE                                SECT 1 & 2   |
|ENABLE  SLOW    DWELL 1   DWELL 1    CHROME    CHROME WATER OK                LATCHED      |
|AUTO    M7S     SEN14     SEN15      SEN16     CHR-OK                         HIPRCHR1,2-LAT|
| N7:37   O:013   I:003     I:003      I:023      B3                               B3       |
|--] [----] [-----] [-------] [-------]/[--------] [-------------------------------(L)------|
|  11      06      15        16         00        277                              269      |
|[158]   [233]                                  [725]                                       |
B3/269 - -] [- - File #2 MAIN_PRGRM -  236
         -(L)- - File #2 MAIN_PRGRM -  235
         -(U)- - File #2 MAIN_PRGRM -  237
Rung #236
|CHROME HI                                                                     CHROME       |
|POWER                                                                         HI POWER     |
|SECT 1 & 2                                                                    SUPPLY 1     |
|LATCHED           CHROME WATER OK                                             OUTPUT       |
|HIPRCHR1,2-LAT  CHR-OK                                                        CHRPS1       |
|       B3              B3                                                      O:033       |
|-------] [-------------] [--------------------------------------------------+----( )----+-|
|      269             277                                                   |    10     | |
|[235]            [725]                                                      |           | |
|                                                                            |CHROME     | |
| O:033/10 - -] [- - File #6 TECH_RUNGS - 6                                  |HI POWER   | |
| B3/831 - -- |- - File #2 MAIN_PRGRM - 620, 622                            |SUPPLY 2   | |
|                                                                            |OUTPUT     | |
|                                                                            |CHRPS2     | |
|                                                                            |  O:033    | |
|                                                                            +----( )----+ |
|                                                                            |    11     | |
|                                                                            |HIGH POWER | |
|                                                                            |CHROME 1 & 2| |
|                                                                            |TO THE FIX | |
|                                                                            |HIPRCH1,2  | |
|                                                                            |     B3    | |
|                                                                            +----( )----+ |
|                                                                                 831       |
Rung #237
|         PALLET    PALLET      PALLET                                         CHROME HI    |
|  AUTO   DETECTED  DETECTED    DETECTED                                       POWER        |
|  MODE   CENTER    RIGHT SIDE  LEFT SIDE                                      SECT 1 & 2   |
|  ENABLE CHROME    CHROME      DWELL 2                                        LATCHED      |
|  AUTO   SEN17     SEN18       SEN19                                          HIPRCHR1,2-LAT|
|  N7:37    I:023     I:023       I:023                                           B3        |
|-+--] [----+--]/[------] [--------] [--+---------------------------------------(U)--------|
| |  11        01        02          03  |                                       269        |
| |[158]                                 |                                                  |
| |                                      | B3/269 - -] [- - File #2 MAIN_PRGRM - 236        |
| |                                      |           -(L)- - File #2 MAIN_PRGRM - 235       |
| |CHROME WATER OK                       |                                                  |
| |CHR-OK                                |                                                  |
| |        B3                            |                                                  |
| +-------]/[----------------------------+                                                  |
| |       277                            |                                                  |
| |[725]                                 |                                                  |
| |AUTO OFF                              |                                                  |
| |PULSE                                 |                                                  |
| |AUOFPULSE                             |                                                  |
| |  T4:283                              |                                                  |
| +-------] [----------------------------+                                                  |
|          TT                                                                               |
|  [155]                                                                                    |
```

```
Rung #238
|                                                                                      TURN ON CHROME |
|                              PALLET         PALLET                                   HI POWER TO    |
|AUTO                          DETECTED       DETECTED                                 SECT 3 & 4     |
|MODE     MOTOR 7   MOTOR 8   RIGHT SIDE     LEFT SIDE                                 TIMER DELAY    |
|ENABLE   SLOW      FAST      DWELL 1        CHROME        CHROME WATER OK             LATCH          |
|AUTO     M7S       M8F       SEN15          SEN16         CHR-OK                      HIPRCHR-3,4-LAT|
| N7:37    O:013     O:012     I:003          I:023           B3                          B3
|--] [------] [------] [------] [-------------] [-------------] [------------------------(L)---------|
|   11       06        17        16             00             277                         263
|[158]    [233]     [249]                                [725]
B3/263 - -] [- - File #2 MAIN_PRGRM -  239
         -(L)- - File #2 MAIN_PRGRM -  238
         -(U)- - File #2 MAIN_PRGRM -  240
Rung #239
|TURN ON CHROME                                                         READY TO TURN
|HI POWER TO                                                            HI POWER TO
|SECT 3 & 4                                                             CHROME SECT 3
|TIMER DELAY                                                            & 4 WHEN PALLET
|LATCH                                                                  @ LEFT SIDE CHR
|HIPRCHR-3,4-LAT                                                        HIPRCHR-3,4-DLY
|        B3                                                             +--TON---------------+
|--------] [-----------------------------------------------------------+TIMER ON DELAY      +-(EN)-
|        263                                                            |TIMER:      T4:300|
|[238]                                                                  |BASE (SEC):   0.01+-(DN)
|                                                                       |PRESET:        300|
|                                                                       |ACCUM:           0|
|                                                                       +------------------+
T4:300.DN - -] [- - File #2 MAIN_PRGRM -  240,241
Rung #240
|                                                                       TURN ON CHROME
|  READY TO TURN                                                        HI POWER TO
|  HI POWER TO                                                          SECT 3 & 4
|  CHROME SECT 3                                                        TIMER DELAY
|  & 4                                                                  LATCH
|  HIPRCHR-3,4-DLY                                                      HIPRCHR-3,4-LAT
|       T4:300                                                              B3
|-+--------] [-----+-------------------------------------------------------(U)--------
| |        DN      |                                                        263
| |[239]           |
| |                | B3/263 - -] [- - File #2 MAIN_PRGRM - 239
| |                |          -(L)- - File #2 MAIN_PRGRM - 238
| |CHROME WATER OK |
| |CHR-OK          |
| |       B3       |
| +-------]/[------+
| |       277      |
| |[725]           |
| |AUTO OFF        |
| |PULSE           |
| |AUOFPULSE       |
| |  T4:283        |
| +------] [-------+
|         TT
|  [155]
```

Rung #241

```
|READY TO TURN                                                    HI POWER TO
|HI POWER TO                                                      CHROME SECT
|CHROME SECT 3                                                    3 & 4
|& 4                                                              LATCHED
|HIPRCHR-3,4-DLY                                                  HIPRCHR3,4-LAT
|   T4:300                                                              B3
|----] [--------------------------------------------------------------(L)----
|    DN                                                                 266
|[239]
B3/266 - ] [ - File #2 MAIN_PRGRM - 242
        -(L)- - File #2 MAIN_PRGRM - 241
        -(U)- - File #2 MAIN_PRGRM - 243
```

Rung #242

```
|HI POWER TO                                                     CHROME
|CHROME SECT                                                     HI POWER
|3 & 4                                                           SUPPLY 3
|LATCHED          CHROME WATER OK                                OUTPUT
|HIPRCHR3,4-LAT   CHR-OK                                         CHRPS3
|      B3               B3                                         O:033
|-----] [---------------] [---------------------------------------+--( )--+--
|      266              277                                        |  12   |
|[241]             [725]                                           |       |
|                                                                  |CHROME
| O:033/12 - ] [ - File #6 TECH_RUNGS - 6                          |HI POWER
| B3/832 - ] [ - File #2 MAIN_PRGRM - 620, 622                     |SUPPLY 4
|                                                                  |OUTPUT
|                                                                  |CHRPS4
|                                                                  | O:033
|                                                                  +--( )--+
|                                                                  |  13
|                                                                  |HIGH POWER
|                                                                  |CHROME 3 & 4
|                                                                  |TO THE FIX
|                                                                  |HIPRCHR3,4
|                                                                  |   B3
|                                                                  +--( )--+
|                                                                     832
```

Rung #243

```
|          PALLET    PALLET                                      HI POWER TO
|  AUTO    DETECTED  DETECTED                                    CHROME SECT
|  MODE    CENTER    RIGHT SIDE                                  3 & 4
|  ENABLE  DWELL 2   DWELL 2                                     LATCHED
|  AUTO    SEN20     SEN21                                       HIPRCHR3,4-LAT
|  N7:37    I:023     I:023                                            B3
|--+--] [-----] [-------] [---+---------------------------------------(U)----
|  |   11      04        05   |                                       266
|  |[158]                     |
|  |                          | B3/266 - ] [ - File #2 MAIN_PRGRM - 242
|  |                          |         -(L)- - File #2 MAIN_PRGRM - 241
|  |CHROME WATER OK           |
|  |CHR-OK                    |
|  |        B3                |
|  +-------]/[----------------+
|  |        277               |
|  |[725]                     |
|  |AUTO OFF                  |
|  |PULSE                     |
|  |AUOFPULSE                 |
|  | T4:283                   |
|  +------] [-----------------+
|         TT
|  [155]
```

Rung #244

```
|PALLET      PALLET
|DETECTED    DETECTED
|LEFT SIDE   RIGHT SIDE
|HEATER 2    HEATER 2                                                 CHROME TIMER
|SEN10       SEN12                                                    CHR_TMR
|  I:003       I:003                                                     T4:71
|---] [---------] [------------------------------------------------------(RES)----
|    11          13
T4:71 - RTO - File #2 MAIN_PRGRM -  246
        RES - File #2 MAIN_PRGRM -  244
```

Rung #245

```
|PALLET      PALLLET    PALLET
|DETECTED    DETECTED   DETECTED
|LEFT SIDE   CENTER     RIGHT SIDE
|DWELL 1     DWELL 1    DWELL 1                                  CHROME COUNTER
|SEN13       SEN14      SEN15                                    CHR_CNT
|  I:003      I:003       I:003                                      B3
|---] [--------] [---------] [-----------------------------------------(L)----
|    14         15          16                                       90
B3/90 - -] [- - File #2 MAIN_PRGRM -  246
        -(L)- - File #2 MAIN_PRGRM -  245
        -(U)- - File #2 MAIN_PRGRM -  247
```

Rung #246

```
|CHROME COUNTER                                       CHROME TIMER
|CHR_CNT                                              CHR_TMR
|      B3                                             +-RTO-----------------+
|-----] [---------------------------------------------|RETENTIVE TIMER ON   |-(EN)-
|      90                                             |TIMER:        T4:71  |
|[245]                                                |BASE (SEC):     1.0  |-(DN)
|                                                     |PRESET:        1000  |
|                                                     |ACCUM:            2  |
|                                                     +---------------------+
T4:71 - RTO - File #2 MAIN_PRGRM -  246
        RES - File #2 MAIN_PRGRM -  244
```

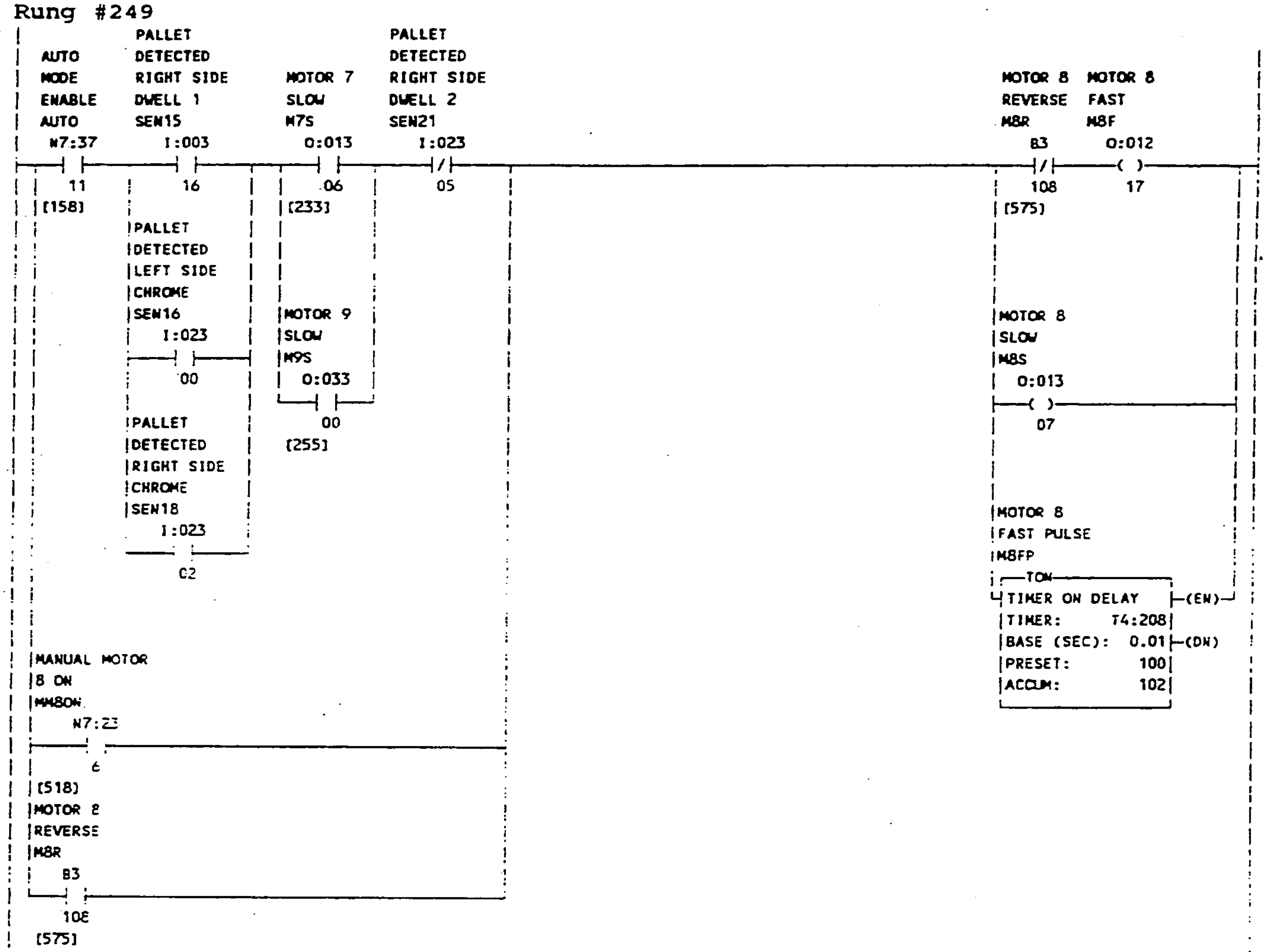
Rung #247

```
|PALLET      PALLET     PALLET
|DETECTED    DETECTED   DETECTED
|LEFT SIDE   CENTER     RIGHT SIDE
|DWELL 2     DWELL 2    DWELL 2                                  CHROME COUNTER
|SEN19       SEN20      SEN21                                    CHR_CNT
|  I:023      I:023       I:023                                      B3
|---] [--------] [---------] [-----------------------------------------(U)----
|    03         04          05                                       90
B3/90 - -] [- - File #2 MAIN_PRGRM -  246
        -(L)- - File #2 MAIN_PRGRM -  245
        -(U)- - File #2 MAIN_PRGRM -  247
```

Rung #248

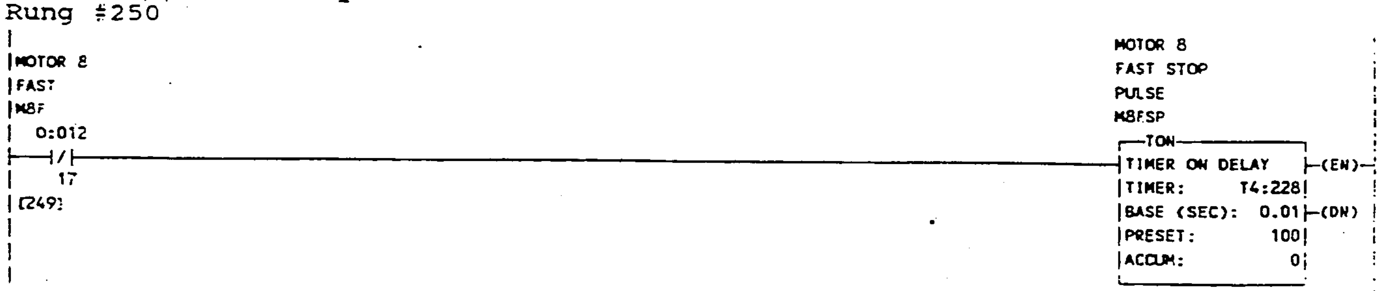
```
| MOTOR 8       MOTOR DRIVE                                    MOTOR 8     |
| SLOW PULSE    PULSER                                         INTERRUPT   |
| M8FP          MDP                                            M8I         |
|   T4:208        B3                                             O:012     |
|-+---] [---+----] [--------------------------------------------( )-------|
| |   TT    |     299                                              07      |
| |[249]    |  [14]                                                        |
| |MOTOR 8  |                                                              |
| |FAST STOP|                                                              |
| |PULSE    |                                                              |
| |M8FSP    |                                                              |
| | T4:228  |                                                              |
| |---] [---|                                                              |
| |   TT    |                                                              |
| |[250]    |                                                              |
| |MOTOR 8  |                                                              |
| |SLOW STOP|                                                              |
| |PULSE    |                                                              |
| |M8SSP    |                                                              |
| | T4:268  |                                                              |
| +---] [---+                                                              |
|     TT                                                                   |
|  [251]                                                                   |
```

Rung #249



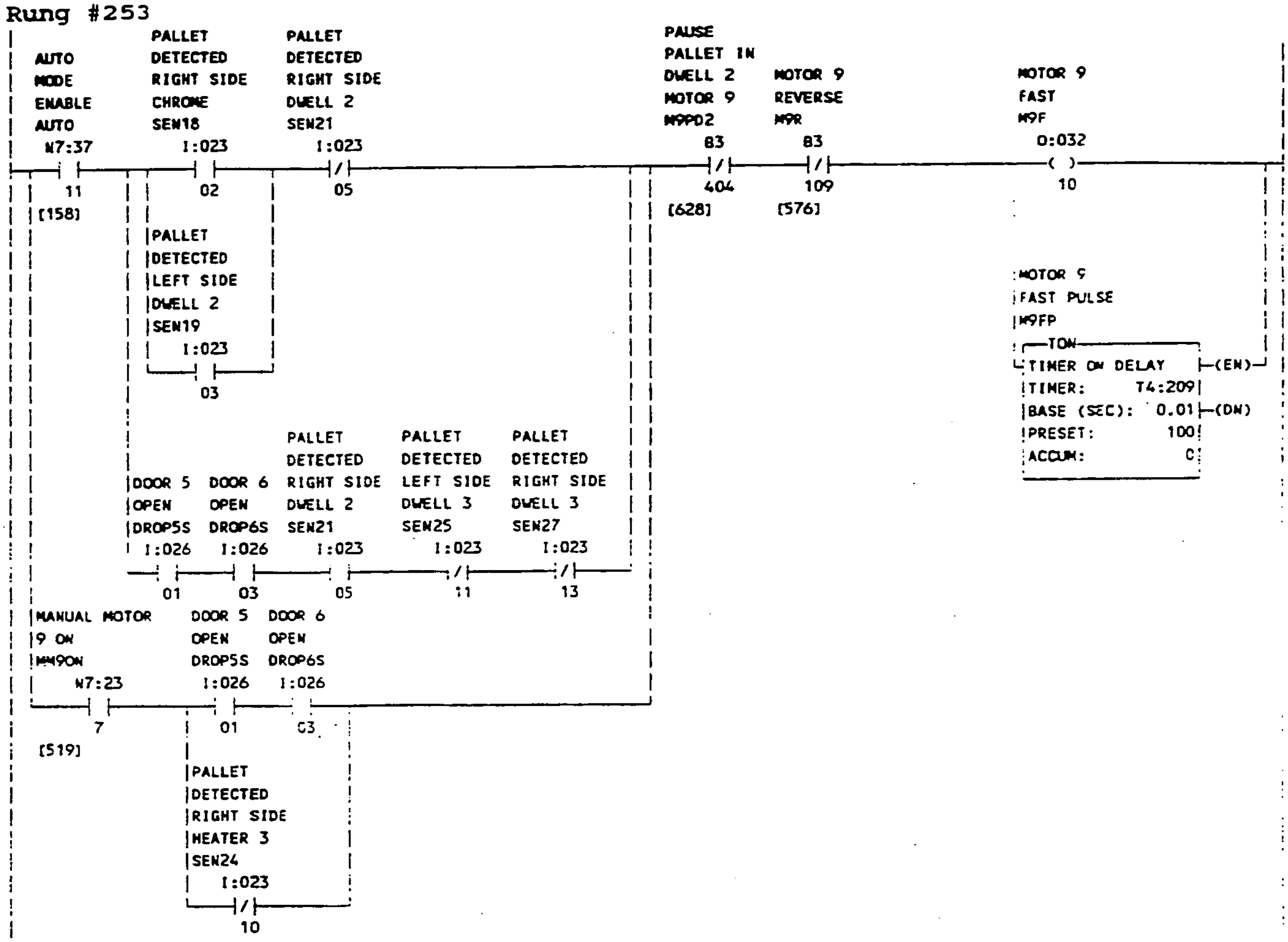

```
O:012/17 - -] [- - File #2 MAIN_PRGRM -  238
                   File #5 FAULTS -  4
           -]/[- - File #2 MAIN_PRGRM -  250
           -( )- - File #2 MAIN_PRGRM -  249
O:013/07 - -]/[- - File #2 MAIN_PRGRM -  251
           -( )- - File #2 MAIN_PRGRM -  249
T4:208.TT - -] [- - File #2 MAIN_PRGRM -  248
```

Rung #250



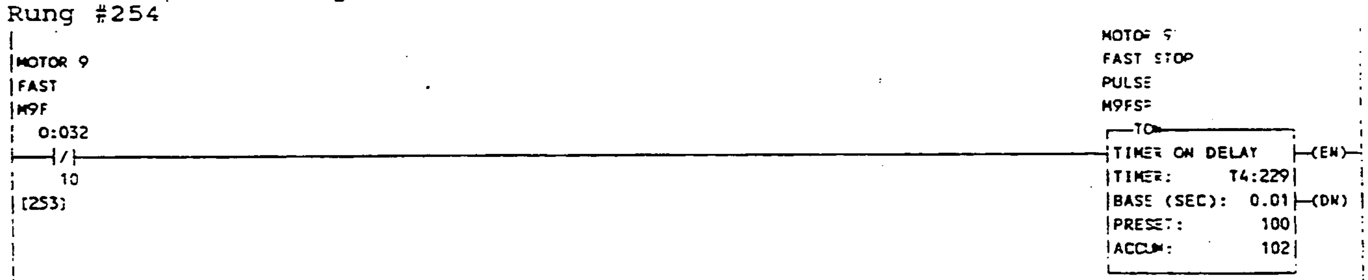
```
T4:228.TT - -| |- - File #2 MAIN_PRC       248
Rung #251
|                                                                    MOTOR 8            |
|MOTOR 8                                                             SLOW STOP          |
|SLOW                                                                PULSE              |
|M8S                                                                 M8SSP              |
| O:013                                                              +-TON-----------+  |
+--|/|---------------------------------------------------------------+TIMER ON DELAY |-(EN)-+
|   07                                                               |TIMER:   T4:268|      |
|[249]                                                               |BASE (SEC): 0.01|-(DN) |
|                                                                    |PRESET:     100|      |
|                                                                    |ACCUM:        0|      |
|                                                                    +---------------+      |
T4:268.TT - -| |- - File #2 MAIN_PRGRM -   248
Rung #252
| MOTOR 9      MOTOR DRIVE                                               MOTOR 9   |
| FAST PULSE   PULSER                                                    INTERRUPT |
| M9FP         MDP                                                       M9I       |
|   T4:209       B3                                                       O:032    |
+-+----] [----+---] [-------------------------------------------------------( )----+
| |    TT     |   299                                                       00
| |[253]      | [14]
| |MOTOR 9    |
| |FAST STOP  |
| |PULSE      |
| |M9FSP      |
| | T4:229    |
| +----] [----+
| |    TT     |
| |[254]      |
| |MOTOR 9    |
| |SLOW PULSE |
| |M9SP       |
| |  T4:249   |
| +----] [----+
| |    TT     |
| |[255]      |
| |MOTOR 9    |
| |SLOW STOP  |
| |PULSE      |
| |M9SSP      |
| | T4:269    |
| +----] [----+
       TT
  [256]
```

Rung #253



O:032/10 - -] [- - File #5 FAULTS - 5
-]/[- - File #2 MAIN_PRGRM - 254
-( )- - File #2 MAIN_PRGRM - 253
T4:209.TT - -] [- - File #2 MAIN_PRGRM - 252

Rung #254



T4:229.TT - -] [- - File #2 MAIN_PRGRM - 252

Rung #255

AUTO MODE ENABLE AUTO
N7:37
11
[158]

PALLET DETECTED RIGHT SIDE CHROME SEN18
I:023
02

PALLET DETECTED LEFT SIDE DWELL 2 SEN19
I:023
03

PALLET DETECTED RIGHT SIDE DWELL 2 SEN21
I:023
05

PAUSE PALLET IN DWELL 2 MOTOR 9 M9PD2
B3
404
[628]

MOTOR 9 SLOW M9S
O:033
( )
00

O:033/00 - ┤ ├ - File #2 MAIN_PRGRM - 249
┤/├ - File #2 MAIN_PRGRM - 256
T4:249.TT - ┤ ├ - File #2 MAIN_PRGRM - 252

MOTOR 9 SLOW PULSE M9SP
TON
TIMER ON DELAY (EN)
TIMER: T4:249
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

MANUAL MOTOR 9 ON MM9ON
N7:23
7
[519]

DOOR 5 OPEN DROP5S
I:026
01

DOOR 6 OPEN DROP6S
I:026
03

PALLET DETECTED RIGHT SIDE HEATER 3 SEN24
I:023
10

MOTOR 9 REVERSE M9R
B3
109
[576]

Rung #256

MOTOR 9 SLOW M9S
O:033
00
[255]

MOTOR 9 SLOW STOP PULSE M9SSP
TON
TIMER ON DELAY (EN)
TIMER: T4:269
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 100

T4:269.TT - ┤ ├ - File #2 MAIN_PRGRM - 252

Rung #257

```
|  MOTOR 10      MOTOR DRIVE                                   MOTOR 10  |
|  FAST PULSE    PULSER                                        INTERRUPT |
|  M10FP         MDP                                           M10I      |
|     T4:210        83                                           O:032   |
|-+---] [---+------] [---------------------------------------------( )---|
| |    TT    |      299                                             01   |
| | [258]    |   [14]                                                    |
| |MOTOR 10  |                                                           |
| |FAST STOP |                                                           |
| |PULSE     |                                                           |
| |M10FSP    |                                                           |
| |  T4:230  |                                                           |
| |---] [----|                                                           |
| |   TT     |                                                           |
| |[259]     |                                                           |
| |MOTOR 10  |                                                           |
| |SLOW PULSE|                                                           |
| |M10SP     |                                                           |
| |  T4:250  |                                                           |
| |---] [----|                                                           |
| |   TT     |                                                           |
| |[260]     |                                                           |
| |MOTOR 10  |                                                           |
| |SLOW STOP |                                                           |
| |PULSE     |                                                           |
| |M10SSP    |                                                           |
| |  T4:270  |                                                           |
| +---] [----+                                                           |
|     TT                                                                 |
  [261]
```

Rung #258

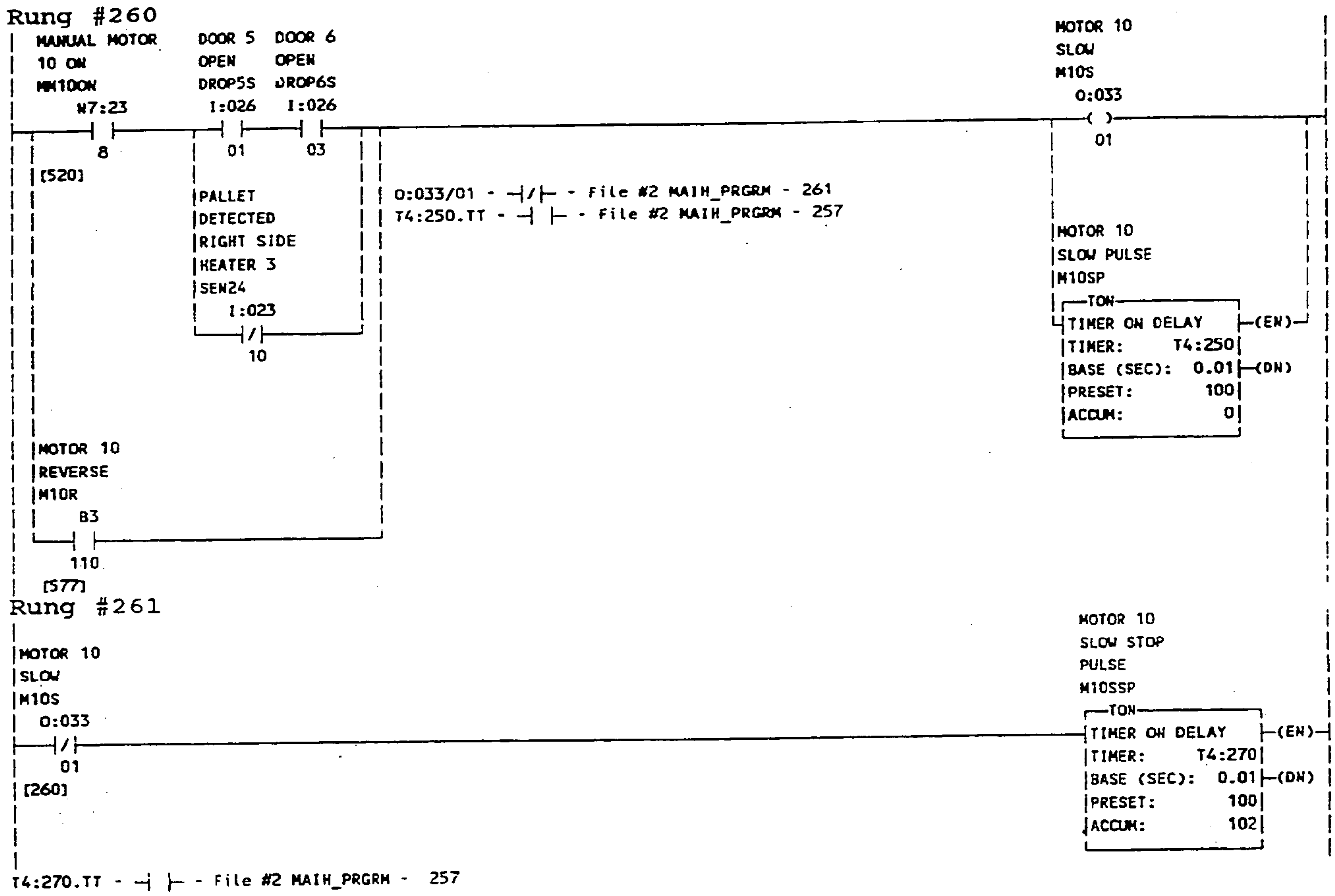
```
|
|  AUTO                              PALLET        PALLET
|  MODE     DOOR 5   DOOR 6          DETECTED      DETECTED                                         MOTOR 10
|  ENABLE   OPEN     OPEN            RIGHT SIDE    RIGHT SIDE    STOP MOTOR 10   MOTOR 10             FAST
|  AUTO     DROP5S   DROP6S          DWELL 2       DWELL 3       PAUSE LATCH     REVERSE              M10F
|  N7:37    I:026    I:026           SEN21         SEN27         M10PL           M10R                 O:032
|                                    I:023         I:023         B3              B3
|---] [------] [------] [-------+------] [------+------]/[-----+------]/[---------]/[--------------+----( )----|
|   11        01       03       |      05      |       13     |      475         110           |     11
|  [158]                        |              |              |  [629]           [577]          |
|                               |PALLET        |              |                                 |MOTOR 10
|                               |DETECTED      |              |                                 |FAST PULSE
|                               |LEFT SIDE     |              |                                 |M10FP
|                               |HEATER 3      |              |                                 +-TON-----------------+
|                               |SEN22         |              |                                 |TIMER ON DELAY       +-(EN)-
|                               |  I:023       |              |                                 |TIMER:        T4:210 |
|                               +------] [-----+              |                                 |BASE (SEC):     0.01 +-(DN)
|                               |      06      |              |                                 |PRESET:          100 |
|                               |              |              |                                 |ACCUM:             0 |
|                               |PALLET        |              |                                 +---------------------+
|                               |DETECTED      |              |
|                               |RIGHT SIDE    |              |
|                               |HEATER 3      |              |
|                               |SEN24         |              |
|                               |  I:023       |              |
|                               +------] [-----+              |
|                                      10                     |
|  |MANUAL MOTOR    DOOR 5   DOOR 6                           |
|  |10 ON           OPEN     OPEN                             |
|  |MM10ON          DROP5S   DROP6S                           |
|  |  N7:23         I:026    I:026                            |
|  +----] [-------+---] [------] [----+-----------------------+
|        8        |    01       03    |
|  [520]          |                   |
|                 |PALLET             |
|                 |DETECTED           |
|                 |RIGHT SIDE         |
|                 |HEATER 3           |
|                 |SEN24              |
|                 |  I:023            |
|                 +------]/[----------+
|                         10
```

O:032/11 - -] [- - File #5 FAULTS - 6
-]/[- - File #2 MAIN_PRGRM - 259
-( )- - File #2 MAIN_PRGRM - 258
T4:210.TT - - - - File #2 MAIN_PRGRM - 257

Rung #259

```
|                                                                                        MOTOR 10
|MOTOR 10                                                                                FAST STOP
|FAST                                                                                    PULSE
|M10F                                                                                    M10FSP
| O:032                                                                                  +-TON-----------------+
|---]/[----------------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|    11                                                                                  |TIMER:        T4:230 |
|[258]                                                                                   |BASE (SEC):     0.01 +-(DN)
|                                                                                        |PRESET:          100 |
|                                                                                        |ACCUM:           102 |
|                                                                                        +---------------------+
```

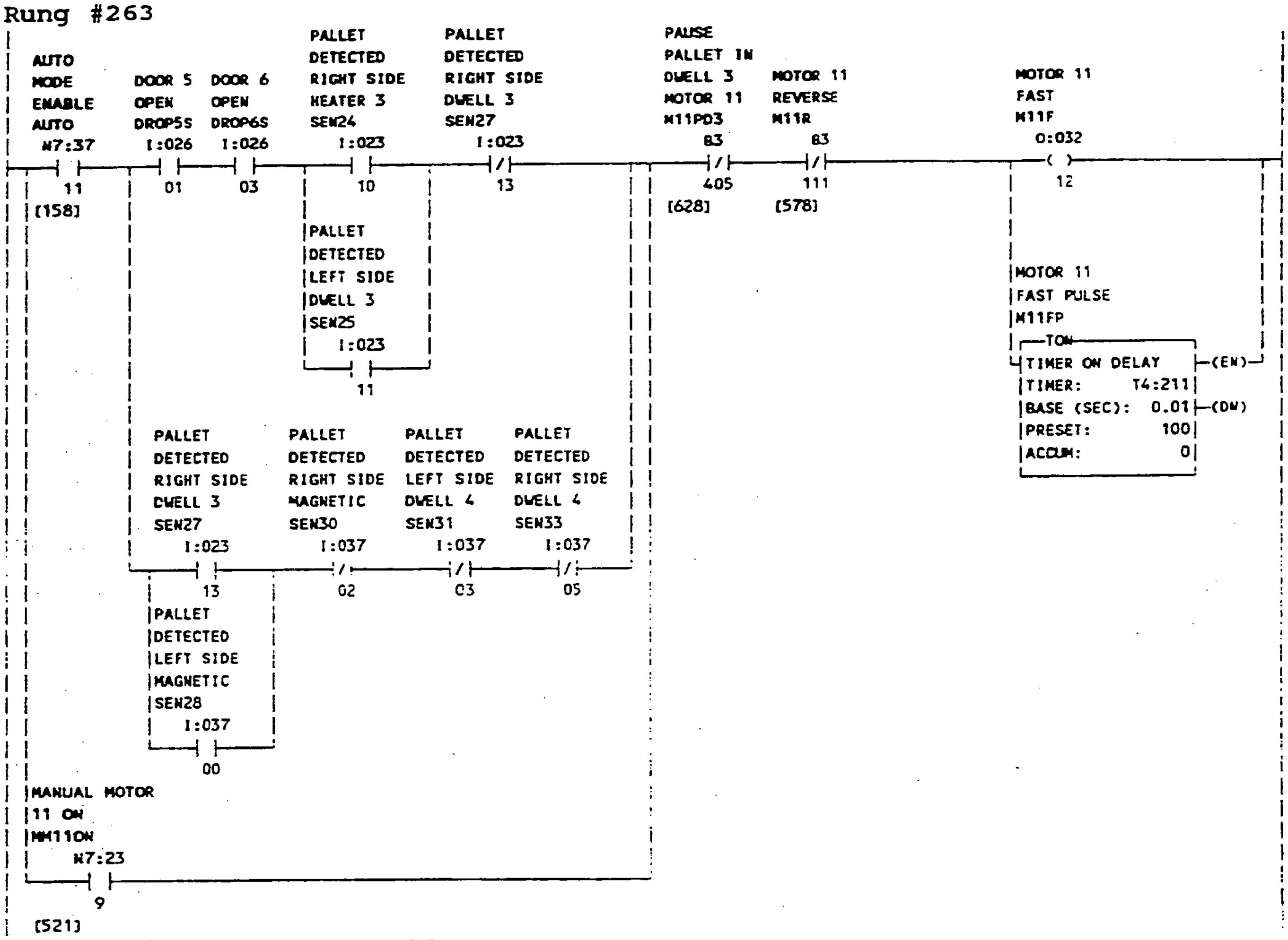
T4:230.TT - -] [- - File #2 MAIN_PRGRM - 257


Rung #260
MANUAL MOTOR 10 ON MM10ON
N7:23
8
[520]
DOOR 5 OPEN DROP5S
I:026
01
DOOR 6 OPEN DROP6S
I:026
03
PALLET DETECTED RIGHT SIDE HEATER 3 SEN24
I:023
10
MOTOR 10 REVERSE M10R
B3
110
[577]
O:033/01 - -|/|- - File #2 MAIN_PRGRM - 261
T4:250.TT - -| |- - File #2 MAIN_PRGRM - 257
MOTOR 10 SLOW M10S
O:033
01
MOTOR 10 SLOW PULSE M10SP
TON
TIMER ON DELAY
TIMER: T4:250
BASE (SEC): 0.01
PRESET: 100
ACCUM: 0
(EN)
(DN)
Rung #261
MOTOR 10 SLOW M10S
O:033
01
[260]
MOTOR 10 SLOW STOP PULSE M10SSP
TON
TIMER ON DELAY
TIMER: T4:270
BASE (SEC): 0.01
PRESET: 100
ACCUM: 102
(EN)
(DN)
T4:270.TT - -| |- - File #2 MAIN_PRGRM - 257

Rung #262

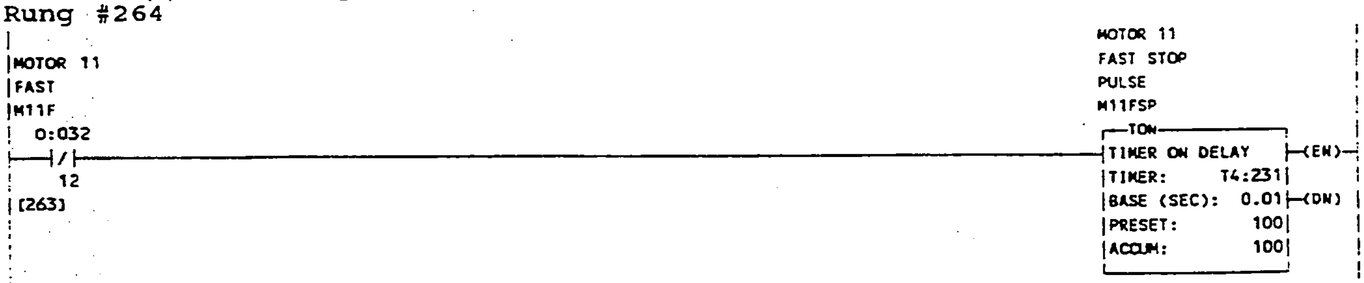
```
| MOTOR 11      MOTOR DRIVE                                  MOTOR 11 |
| FAST PULSE    PULSER                                       INTERRUPT|
| M11FP         MDP                                          M11I     |
|   T4:211        B3                                          O:032   |
|-+---] [---+-----] [-----------------------------------------( )-----|
| |   TT    |    299                                           02     |
| |[263]    | [14]                                                    |
| |MOTOR 11 |                                                         |
| |FAST STOP|                                                         |
| |PULSE    |                                                         |
| |M11FSP   |                                                         |
| |  T4:231 |                                                         |
| |---] [---|                                                         |
| |   TT    |                                                         |
| |[264]    |                                                         |
| |MOTOR 11 |                                                         |
| |SLOW PULSE                                                         |
| |M11SP    |                                                         |
| |  T4:251 |                                                         |
| |---] [---|                                                         |
| |   TT    |                                                         |
| |[265]    |                                                         |
| |MOTOR 11 |                                                         |
| |SLOW STOP|                                                         |
| |PULSE    |                                                         |
| |M11SSP   |                                                         |
| |  T4:271 |                                                         |
| +---] [---+                                                         |
|     TT                                                              |
|  [266]                                                              |
```

Rung #263



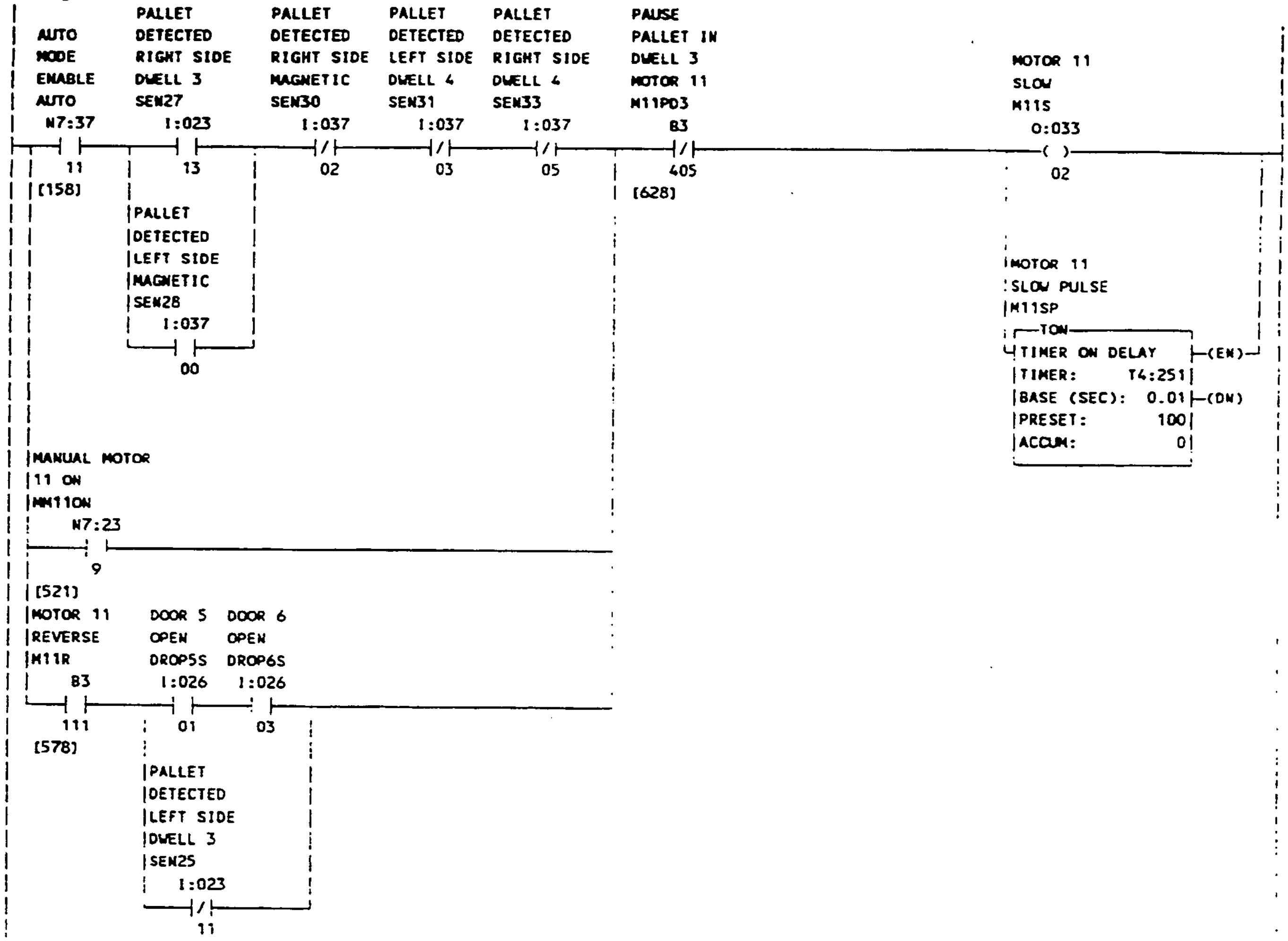
O:032/12 - ⊣ ⊢ - File #2 MAIN_PRGRM - 267
File #5 FAULTS - 6
⊣/⊢ - File #2 MAIN_PRGRM - 264
-( )- - File #2 MAIN_PRGRM - 263
T4:211.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 262

Rung #264



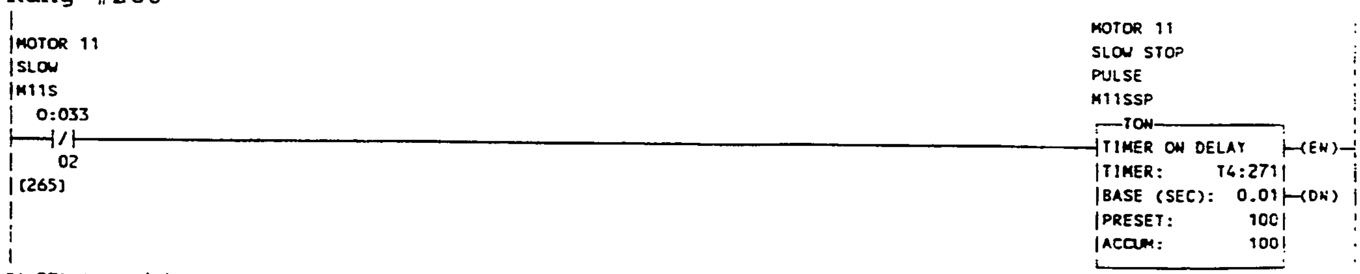
T4:231.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 262

Rung #265



O:033/02 - -] [- - File #2 MAIN_PRGRM - 270,281
-]/[- - File #2 MAIN_PRGRM - 266
-( )- - File #2 MAIN_PRGRM - 265
T4:251.TT - -] [- - File #2 MAIN_PRGRM - 262

Rung #266



T4:271.TT - -] [- - File #2 MAIN_PRGRM - 262

Rung #267

```
                       PALLET      PALLET                                   MAGNETIC
                       DETECTED    DETECTED                                 HI POWER
|AUTO                  RIGHT SIDE  LEFT SIDE                                SECTIONS
|MODE      MOTOR 11    DWELL 3     MAGNETIC   MAG WATER OK                  1 AND 2
|ENABLE    FAST        SEN27       SEN28      MAG_OK                        LATCHED
|AUTO      M11F                                                             HIPRMAG1,2-LAT
| W7:37    O:032       I:023       I:037      B3                                 B3
|--] [------] [----------] [---------]/[--------] [-------------------------------(L)----|
|   11       12          13          00        278                              270
|[158]    [263]                               [726]
B3/270 - ] [ - File #2 MAIN_PRGRM - 268
       -(L)- - File #2 MAIN_PRGRM - 267
       -(U)- - File #2 MAIN_PRGRM - 269
```

Rung #268

```
|MAGNETIC                                                                  MAGNETIC
|HI POWER                                                                  HI POWER
|SECTIONS                                                                  SUPPLY 1
|1 AND 2                                                                   OUTPUT
|LATCHED           MAG WATER OK                                            MAGPS1
|HIPRMAG1,2-LAT    MAG_OK                                                   O:033
|      B3                B3                                            +----( )----+--|
|------] [---------------] [-------------------------------------------+     14    |  |
|     270               278                                            |MAGNETIC   |  |
|[267]                 [726]                                           |HI POWER   |  |
|                                                                      |SUPPLY 2   |  |
| O:033/14 - ] [ - File #6 TECH_RUNGS - 6                              |OUTPUT     |  |
| B3/833 - ] [ - File #2 MAIN_PRGRM - 620, 622                         |MAGPS2     |  |
|                                                                      |  O:033    |  |
|                                                                      +----( )----+  |
|                                                                      |    15     |  |
|                                                                      |HIGH POWER |  |
|                                                                      |MAG 1 & 2  |  |
|                                                                      |TO THE FIX |  |
|                                                                      |HIMAG1,2   |  |
|                                                                      |    B3     |  |
|                                                                      +----( )----+  |
|                                                                          833        |
```

269

```
Rung #269
|                                                                                        MAGNETIC          |
|          PALLET    PALLET      PALLET                                                  HI POWER          |
| AUTO     DETECTED  DETECTED    DETECTED                                                SECTIONS          |
| MODE     CENTER    RIGHT SIDE  LEFT SIDE                                               1 AND 2           |
| ENABLE   MAGNETIC  MAGNETIC    DWELL 4                                                 LATCHED           |
| AUTO     SEN29     SEN30       SEN31                                                   HIPRMAG1,2-LAT    |
|  N7:37    I:037     I:037       I:037                                                        B3         |
|--| |------|/|-------| |----------| |------------------------------------------------------(U)-----------|
| |  11       01        02          03      |                                                 270          |
| |[158]                                    |                                                              |
| |                                         | B3/270 - -| |- - File #2 MAIN_PRGRM - 268                  |
| |                                         |          -(L)- - File #2 MAIN_PRGRM - 267                  |
| |MAG WATER OK                             |                                                              |
| |MAG_OK                                   |                                                              |
| |      B3                                 |                                                              |
| |-----|/|---------------------------------|                                                              |
| |     278                                 |                                                              |
| |[726]                                    |                                                              |
| |AUTO OFF                                 |                                                              |
| |PULSE                                    |                                                              |
| |AUOFPULSE                                |                                                              |
| |  T4:283                                 |                                                              |
| |----| |----------------------------------                                                               |
|        TT                                                                                                |
|  [155]
Rung #270
|                                                                                        TURN ON MAG       |
|        PALLET      PALLET                                                              HI POWER TO       |
|AUTO    DETECTED    DETECTED                                                            SECT 3 AND 4      |
|MODE    RIGHT SIDE  LEFT SIDE   MOTOR 11  MOTOR 12                                      TIMER DELAY       |
|ENABLE  DWELL 3     MAGNETIC    SLOW      FAST      MAG WATER OK                        LATCH             |
|AUTO    SEN27       SEN28       M11S      M12F      MAG_OK                              HIPRMAG-3,4-LAT   |
| N7:37    I:023      I:037      O:033     O:032       B3                                      B3         |
|-| |------| |--------| |--------| |-------| |--------| |---------------------------------------(L)---------|
|  11        13         00         02        13        278                                    264         |
|[158]                           [265]     [281]     [726]                                                 |
B3/264 - -| |- - File #2 MAIN_PRGRM -  271
         -(L)- - File #2 MAIN_PRGRM -  270
         -(U)- - File #2 MAIN_PRGRM -  272
Rung #271
|TURN ON MAG                                                               READY TO TURN           |
|HI POWER TO                                                               HI POWER TO             |
|SECT 3 AND 4                                                              MAG SECT 3 & 4          |
|TIMER DELAY                                                               WHEN PALLET @           |
|LATCH                                                                     LEFT SIDE MAG           |
|HIPRMAG-3,4-LAT                                                           HIPRMAG-3,4-DLY         |
|       B3                                                                 +-TON---------------+   |
|------| |-----------------------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|       264                                                                |TIMER:      T4:301 |   |
|[270]                                                                     |BASE (SEC):  0.01 +-(DN) |
|                                                                          |PRESET:       300 |   |
|                                                                          |ACCUM:          0 |   |
|                                                                          +-------------------+   |
T4:301.DN - -| |- - File #2 MAIN_PRGRM -  272,273
```

270

```
Rung #272                                                          TURN ON MAG
|                                                                  HI POWER TO
|                                                                  SECT 3 AND 4
| READY TO TURN                                                    TIMER DELAY
| HI POWER TO                                                      LATCH
| MAG SECT 3 & 4                                                   HIPRMAG-3,4-LAT
| HIPRMAG-3,4-DLY                                                      B3
|       T4:301                                                                     |
|-+----] [-------+----------------------------------------------------(U)---------|
| |      DN      |                                                    264          |
| |[271]         |                                                                 |
| |              | B3/264 - -] [- - File #2 MAIN_PRGRM - 271                       |
| |              |        -(L)- - File #2 MAIN_PRGRM - 270                         |
| |MAG WATER OK  |                                                                 |
| |MAG_OK        |                                                                 |
| |     B3       |                                                                 |
| |----]/[-------|                                                                 |
| |    278       |                                                                 |
| |[726]         |                                                                 |
| |AUTO OFF      |                                                                 |
| |PULSE         |                                                                 |
| |AUOFPULSE     |                                                                 |
| |  T4:283      |                                                                 |
| +----] [-------+                                                                 |
|       TT
| [155]
Rung #273                                                          HI POWER TO
|                                                                  MAGNETIC
|                                                                  SECTIONS
|READY TO TURN                                                     3 AND 4
|HI POWER TO                                                       LATCHED
|MAG SECT 3 & 4                                                    HIPRMAG3,4-LAT
|HIPRMAG-3,4-DLY                                                       B3
|     T4:301                                                                       |
|------] [-------------------------------------------------------------(L)--------|
|       DN                                                             267         |
|[271]
B3/267 - -] [- - File #2 MAIN_PRGRM - 274
         -(L)- - File #2 MAIN_PRGRM - 273
         -(U)- - File #2 MAIN_PRGRM - 275
```

```
Rung #274
|HI POWER TO                                                         MAGNETIC
|MAGNETIC                                                            HI POWER
|SECTIONS                                                            SUPPLY 3
|3 AND 4                                                             OUTPUT
|LATCHED           MAG WATER OK                                      MAGPS3
|HIPRMAG3,4-LAT    MAG_OK                                              O:063
|      B3             B3
|----] [-----------] [------------------------------------------------+---( )---
|     267            278                                              |    10
|[273]            [726]                                               |
|                                                                     |MAGNETIC
| O:063/10 - ] [ - File #6 TECH_RUNGS - 6                             |HI POWER
| B3/834 - ] [ - File #2 MAIN_PRGRM - 620, 622                        |SUPPLY 4
|                                                                     |OUTPUT
|                                                                     |MAGPS4
|                                                                     |  O:063
|                                                                     +---( )---
|                                                                     |    11
|                                                                     |HIGH POWER
|                                                                     |MAG 3 & 4
|                                                                     |TO THE FIX
|                                                                     |HIPRMAG3,4
|                                                                     |    B3
|                                                                     +---( )---
|                                                                         834
Rung #275
|                                                                    HI POWER TO
|         PALLET    PALLET                                           MAGNETIC
| AUTO    DETECTED  DETECTED                                         SECTIONS
| MODE    MIDDLE    RIGHT SIDE                                       3 AND 4
| ENABLE  DWELL 4   DWELL 4                                          LATCHED
| AUTO    SEN32     SEN33                                            HIPRMAG3,4-LAT
|  N7:37    I:037     I:037                                              B3
|-+--] [-----] [-------] [----+------------------------------------------(U)---
| |   11      04        05    |                                          267
| |[158]                      |
| |                           | B3/267 - ] [ - File #2 MAIN_PRGRM - 274
| |                           |        -(L)- - File #2 MAIN_PRGRM - 273
| |MAG WATER OK               |
| |MAG_OK                     |
| |     B3                    |
| +----]/[--------------------+
| |    278                    |
| |[726]                      |
| |AUTO OFF                   |
| |PULSE                      |
| |AUOFPULSE                  |
| |  T4:283                   |
| +----] [--------------------+
|       TT
| [155]
Rung #276
|PALLET      PALLET
|DETECTED    DETECTED
|LEFT SIDE   RIGHT SIDE
|HEATER 3    HEATER 3                                                MAGNETIC TIMER
|SEN22       SEN24                                                   MAG_TMR
|  I:023       I:023                                                     T4:72
|----] [-------] [--------------------------------------------------------[RES]---
|    06        10
T4:72 - RTO - File #2 MAIN_PRGRM -  278
```

```
        RES - File #2 MAIN_PRGRM - 
Rung #277
|PALLET      PALLET     PALLET
|DETECTED    DETECTED   DETECTED
|LEFT SIDE   CENTER     RIGHT SIDE                                          MAGNETIC
|DWELL 3     DWELL 3    DWELL 3                                             TRANSIT
|SEN25       SEN26      SEN27                                               MAG_TRAN
|  I:023       I:023      I:023                                                B3
|---] [---------] [---------] [--------------------------------------------------(L)---|
|    11          12         13                                                 91
B3/91 - ] [ - File #2 MAIN_PRGRM - 278
        -(L)- - File #2 MAIN_PRGRM - 277
        -(U)- - File #2 MAIN_PRGRM - 279
Rung #278
|MAGNETIC
|TRANSIT                                                 MAGNETIC TIMER
|MAG_TRAN                                                MAG_TMR
|   B3                                                   +-RTO-----------------+
|---] [--------------------------------------------------|RETENTIVE TIMER ON   |-(EN)-|
|   91                                                   |TIMER:          T4:72|
|[277]                                                   |BASE (SEC):       1.0|-(DN)
|                                                        |PRESET:          1000|
|                                                        |ACCUM:             79|
|                                                        +---------------------+
T4:72 - RTO - File #2 MAIN_PRGRM - 278
        RES - File #2 MAIN_PRGRM - 276
Rung #279
|PALLET      PALLET     PALLET
|DETECTED    DETECTED   DETECTED
|LEFT SIDE   MIDDLE     RIGHT SIDE                                          MAGNETIC
|DWELL 4     DWELL 4    DWELL 4                                             TRANSIT
|SEN31       SEN32      SEN33                                               MAG_TRAN
|  I:037       I:037      I:037                                                B3
|---] [---------] [---------] [--------------------------------------------------(U)---|
|    03          04         05                                                 91
B3/91 - ] [ - File #2 MAIN_PRGRM - 278
        -(L)- - File #2 MAIN_PRGRM - 277
        -(U)- - File #2 MAIN_PRGRM - 279
Rung #280
| MOTOR 12      MOTOR DRIVE                                                 MOTOR 12
| SLOW PULSE    PULSER                                                      INTERRUPT
| M12SP         MDP                                                         M121
|   T4:212        B3                                                          O:032
|-+---] [---+-----] [-------------------------------------------------------( )----|
| |    TT   |     299                                                         03
| |[281]    |  [14]
| |MOTOR 12 |
| |FAST STOP|
| |PULSE    |
| |M12FSP   |
| |  T4:232 |
| +---] [---+
| |    TT   |
| |[282]    |
| |MOTOR 12 |
| |SLOW STOP|
| |PULSE    |
| |M12SSP   |
| |  T4:272 |
| +---] [---+
|      TT
|  [283]
```

```
Rung #281
       PALLET                          PALLET
AUTO   DETECTED                        DETECTED
MODE   RIGHT SIDE      MOTOR 11        RIGHT SIDE                MOTOR 12   MOTOR 12
ENABLE DWELL 3         SLOW            DWELL 4                   REVERSE    FAST
AUTO   SEN27           M11S            SEN33                     M12R       M12F
N7:37    I:023         0:033           I:037                      B3        0:032
--] [------] [----------] [------------]/[-------------------------]/[--------( )--
  11        13           02              05                       112        13
[158]                  [265]                                     [579]
        PALLET
        DETECTED
        LEFT SIDE
        MAGNETIC                                                 MOTOR 12
        SEN28          MOTOR 13                                  SLOW
          I:037        SLOW                                      M12S
       ---] [---       M13S                                       0:033
            00           0:033                                 ---( )---
                       ---] [---                                    03
        PALLET             04
        DETECTED       [287]
        RIGHT SIDE
        MAGNETIC                                                 MOTOR 12
        SEN30                                                    SLOW PULSE
          I:037                                                  M12SP
       ---] [---                                                 +--TON----------------+
            02                                                 --|TIMER ON DELAY       |-(EN)-
                                                                 |TIMER:       T4:212  |
                                                                 |BASE (SEC):    0.01  |-(DN)
MANUAL MOTOR                                                     |PRESET:         100  |
12 ON                                                            |ACCUM:            0  |
MM12ON                                                           +---------------------+
   N7:23
---] [---
     10
[522]
MOTOR 12
REVERSE
M12R
   B3
---] [---
    112
 [579]
0:032/13 - ] [ - - File #2 MAIN_PRGRM -  270
                   File #5 FAULTS -  7
           ]/[ - - File #2 MAIN_PRGRM -  282
           -( )- - File #2 MAIN_PRGRM -  281
0:033/03 - ]/[ - - File #2 MAIN_PRGRM -  283
           -( )- - File #2 MAIN_PRGRM -  281
T4:212.TT - ] [ - - File #2 MAIN_PRGRM -  280
Rung #282
                                                                 MOTOR 12
MOTOR 12                                                         FAST STOP
FAST                                                             PULSE
M12F                                                             M12FSP
  0:032                                                          +--TON----------------+
---]/[-----------------------------------------------------------|TIMER ON DELAY       |-(EN)-
    13                                                           |TIMER:       T4:232  |
[281]                                                            |BASE (SEC):    0.01  |-(DN)
                                                                 |PRESET:         100  |
                                                                 |ACCUM:          102  |
                                                                 +---------------------+
```

```
T4:232.TT - -| |- - File #2 MAIN_PRGR/      280
Rung #283
|                                                            MOTOR 12          |
|MOTOR 12                                                    SLOW STOP         |
|SLOW                                                        PULSE             |
|M12S                                                        M12SSP            |
|  O:033                                                     +-TON-----------+ |
|---|/|------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|    03                                                      |TIMER:   T4:272| |
|[281]                                                       |BASE (SEC): 0.01+-(DN)|
|                                                            |PRESET:     100| |
|                                                            |ACCUM:      102| |
|                                                            +---------------+ |
T4:272.TT - -| |- - File #2 MAIN_PRGRM -  280
Rung #284
|  MOTOR 13     MOTOR DRIVE                                  MOTOR 13   |
|  FAST PULSE   PULSER                                       INTERRUPT  |
|  M13FP        MDP                                          M13I       |
|    T4:213       B3                                           O:032    |
|-+---| |------+---| |-----------------------------------------( )------|
| |     TT     |   299                                          04      |
| |[285]       |  [14]                                                  |
| |MOTOR 13    |
| |FAST STOP   |
| |PULSE       |
| |M13FSP      |
| |  T4:233    |
| +---| |------+
| |     TT     |
| |[286]       |
| |MOTOR 13    |
| |SLOW PULSE  |
| |M13SP       |
| |   T4:253   |
| +---| |------+
| |     TT     |
| |[287]       |
| |MOTOR 13    |
| |SLOW STOP   |
| |PULSE       |
| |M13SSP      |
| |  T4:273    |
| +---| |------+
|       TT
|  [288]
```

Rung #285

AUTO MODE ENABLE AUTO N7:37 11 [158]

PALLET DETECTED RIGHT SIDE MAGNETIC SEN30 I:037 02

PALLET DETECTED RIGHT SIDE DWELL 4 SEN33 I:037 05

PALLET DETECTED LEFT SIDE DWELL 4 SEN31 I:037 03

DOOR 7 OPEN DROP7S I:042 01

DOOR 8 OPEN DROP8S I:042 03

PALLET DETECTED RIGHT SIDE DWELL 4 SEN33 I:037 05

PALLET DETECTED LEFT SIDE DWELL 5 SEN37 I:037 11

PALLET DETECTED RIGHT SIDE DWELL 5 SEN39 I:037 13

MANUAL MOTOR 13 ON MM13ON N7:23 11 [523]

DOOR 7 OPEN DROP7S I:042 01

DOOR 8 OPEN DROP8S I:042 03

PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36 I:037 10

PAUSE PALLET IN DWELL 4 MOTOR 13 M13PD4 B3 406 [628]

MOTOR 13 REVERSE M13R B3 113 [580]

MOTOR 13 FAST M13F O:032 ( ) 14

MOTOR 13 FAST PULSE M13FP

TON TIMER ON DELAY (EN)
TIMER: T4:213
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

O:032/14 - ┤ ├ - File #5 FAULTS - 8
┤/├ - File #2 MAIN_PRGRM - 286
-( )- - File #2 MAIN_PRGRM - 285
T4:213.TT - ┤ ├ - File #2 MAIN_PRGRM - 284

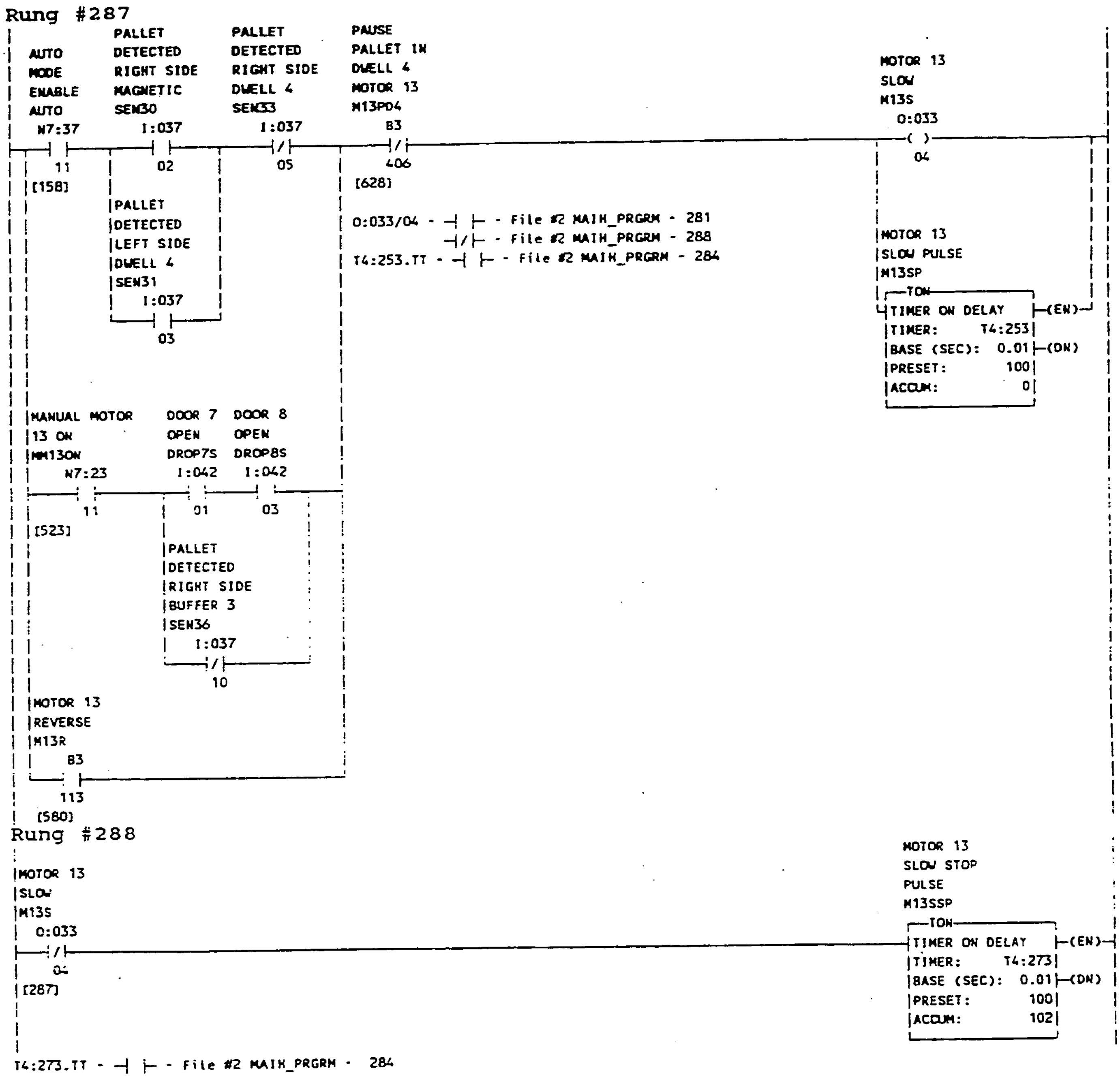
Rung #286

MOTOR 13 FAST M13F O:032 14 [285]

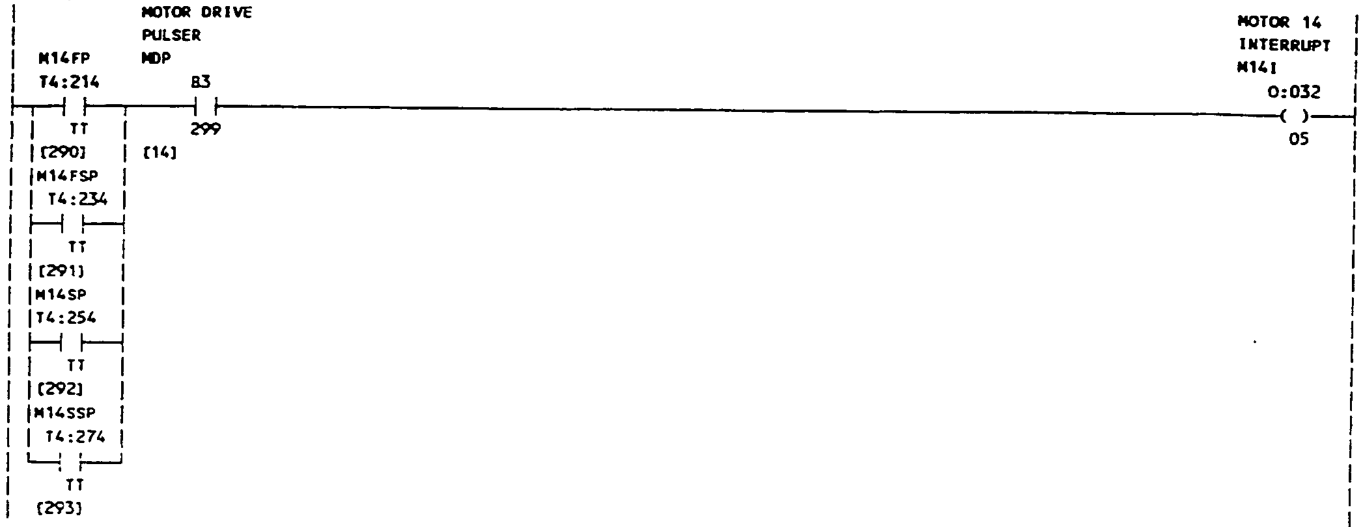
MOTOR 13 FAST STOP PULSE M13FSP

TON TIMER ON DELAY (EN)
TIMER: T4:233
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 102

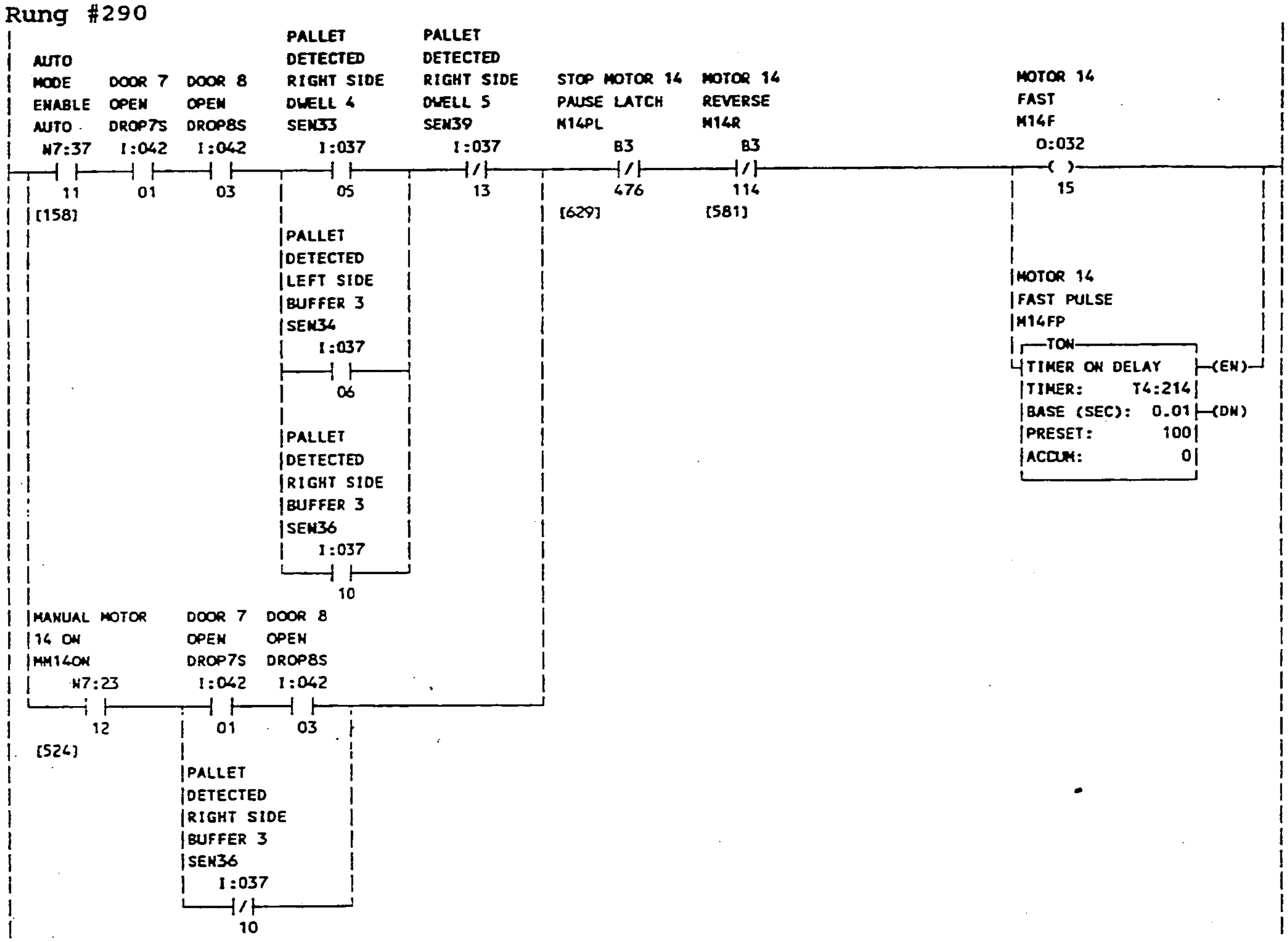
T4:233.TT - ┤ ├ - File #2 MAIN_PRGRM - 284


Rung #287
AUTO MODE ENABLE AUTO
N7:37
11
[158]
PALLET DETECTED RIGHT SIDE MAGNETIC SEN30
I:037
02
PALLET DETECTED RIGHT SIDE DWELL 4 SEN33
I:037
05
PAUSE PALLET IN DWELL 4 MOTOR 13 M13PD4
B3
406
[628]
MOTOR 13 SLOW M13S
O:033
04
PALLET DETECTED LEFT SIDE DWELL 4 SEN31
I:037
03
O:033/04 - ┤ ├ - File #2 MAIN_PRGRM - 281
┤/├ - File #2 MAIN_PRGRM - 288
T4:253.TT - ┤ ├ - File #2 MAIN_PRGRM - 284
MOTOR 13 SLOW PULSE M13SP
TON
TIMER ON DELAY
TIMER: T4:253
BASE (SEC): 0.01
PRESET: 100
ACCUM: 0
(EN)
(DN)
MANUAL MOTOR 13 ON MM13ON
N7:23
11
[523]
DOOR 7 OPEN DROP7S
I:042
01
DOOR 8 OPEN DROP8S
I:042
03
PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36
I:037
10
MOTOR 13 REVERSE M13R
B3
113
[580]
Rung #288
MOTOR 13 SLOW M13S
O:033
04
[287]
MOTOR 13 SLOW STOP PULSE M13SSP
TON
TIMER ON DELAY
TIMER: T4:273
BASE (SEC): 0.01
PRESET: 100
ACCUM: 102
(EN)
(DN)
T4:273.TT - ┤ ├ - File #2 MAIN_PRGRM - 284

Rung #289

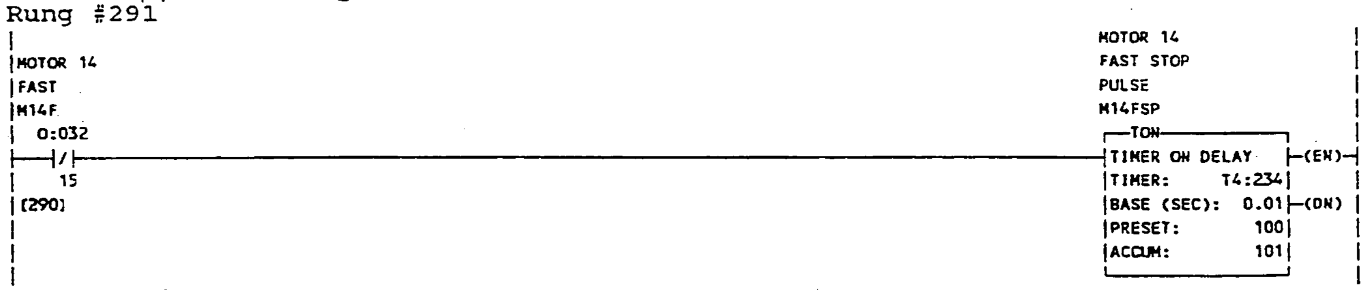

MOTOR DRIVE
PULSER
MDP
M14FP
T4:214
B3
299
TT
[290]
[14]
M14FSP
T4:234
TT
[291]
M14SP
T4:254
TT
[292]
M14SSP
T4:274
TT
[293]
MOTOR 14
INTERRUPT
M14I
O:032
05

Rung #290

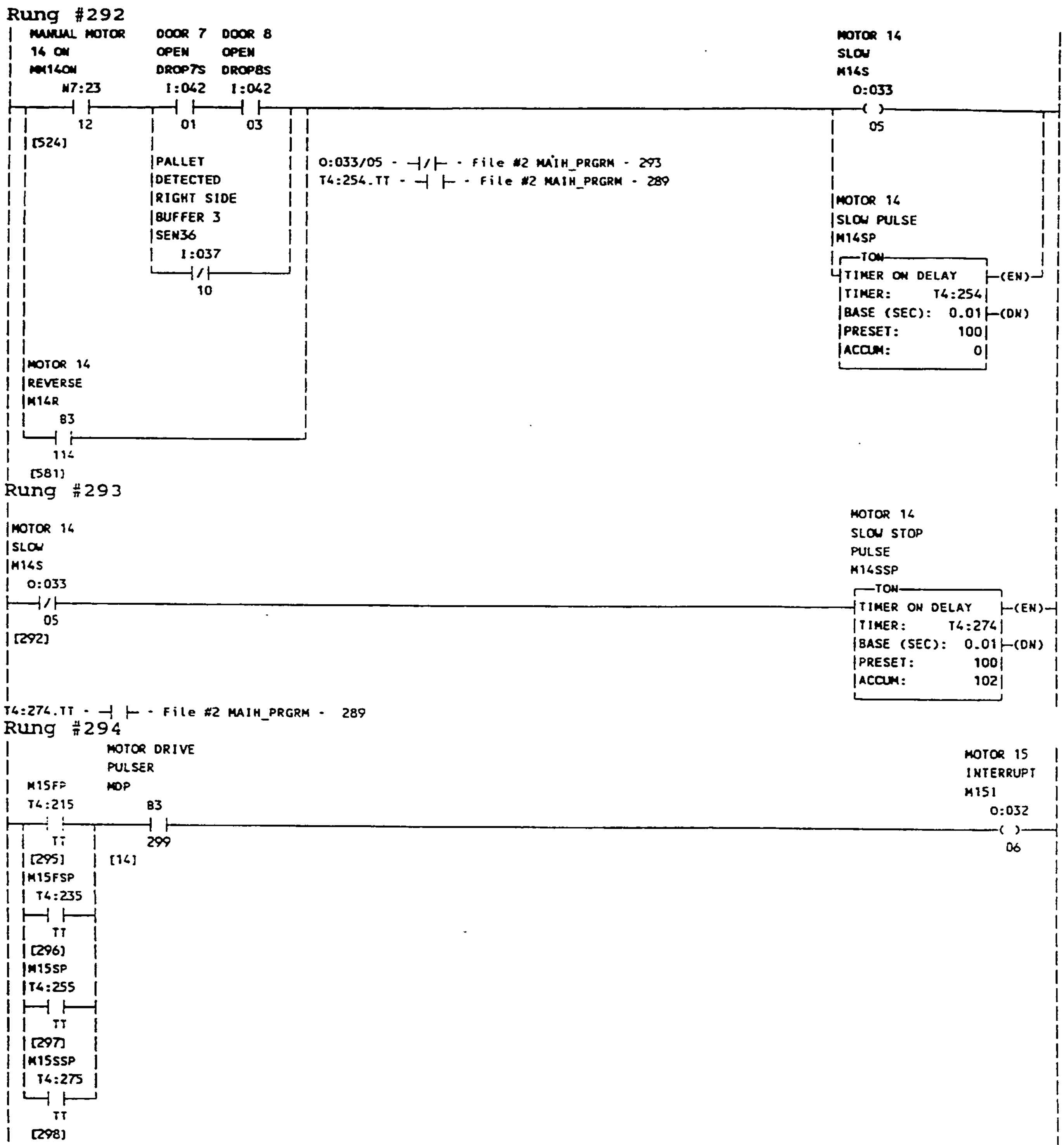


O:032/15 - ┤ ├ - File #5 FAULTS - 9
┤/├ - File #2 MAIN_PRGRM - 291
-( )- - File #2 MAIN_PRGRM - 290
T4:214.TT - ┤ ├ - File #2 MAIN_PRGRM - 289

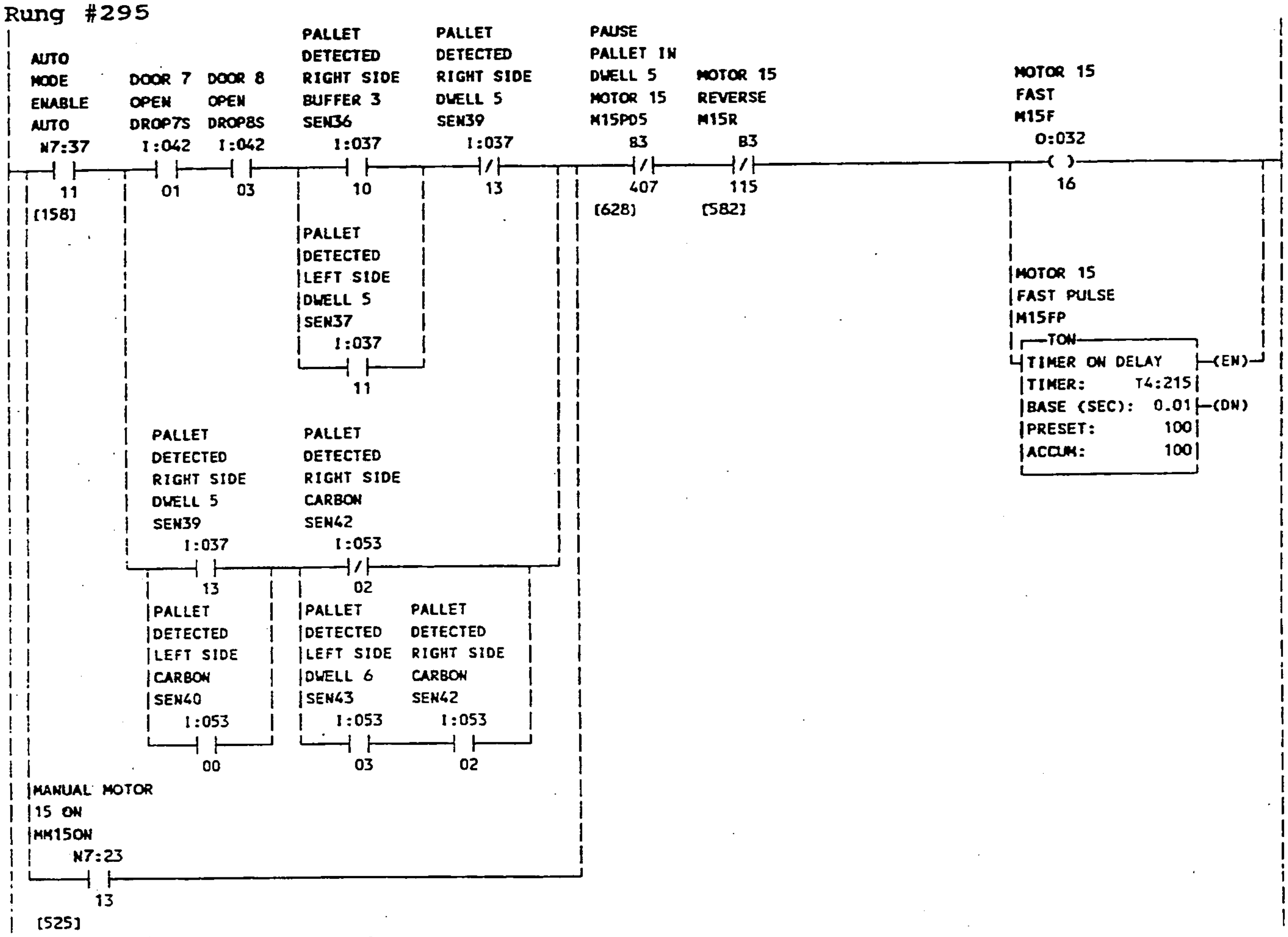
Rung #291



T4:234.TT - ┤ ├ - File #2 MAIN_PRGRM - 289

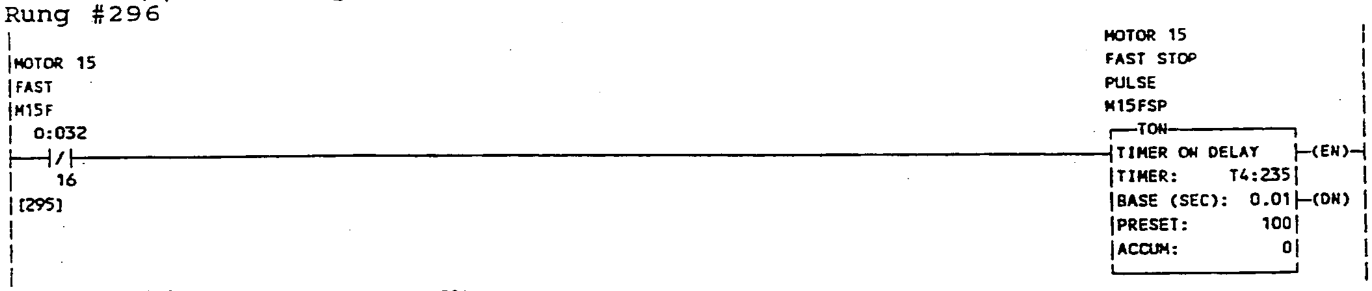

Rung #292
MANUAL MOTOR
14 ON
MM14ON
N7:23
12
[524]
DOOR 7
OPEN
DROP7S
I:042
01
DOOR 8
OPEN
DROP8S
I:042
03
PALLET
DETECTED
RIGHT SIDE
BUFFER 3
SEN36
I:037
10
MOTOR 14
REVERSE
M14R
B3
114
[581]
O:033/05 - -|/|- - File #2 MAIN_PRGRM - 293
T4:254.TT - -| |- - File #2 MAIN_PRGRM - 289
MOTOR 14
SLOW
M14S
O:033
05
MOTOR 14
SLOW PULSE
M14SP
TON
TIMER ON DELAY
TIMER: T4:254
BASE (SEC): 0.01
PRESET: 100
ACCUM: 0
(EN)
(DN)
Rung #293
MOTOR 14
SLOW
M14S
O:033
05
[292]
MOTOR 14
SLOW STOP
PULSE
M14SSP
TON
TIMER ON DELAY
TIMER: T4:274
BASE (SEC): 0.01
PRESET: 100
ACCUM: 102
(EN)
(DN)
T4:274.TT - -| |- - File #2 MAIN_PRGRM - 289
Rung #294
M15FP
T4:215
TT
[295]
M15FSP
T4:235
TT
[296]
M15SP
T4:255
TT
[297]
M15SSP
T4:275
TT
[298]
MOTOR DRIVE
PULSER
MDP
B3
299
[14]
MOTOR 15
INTERRUPT
M15I
O:032
06

Rung #295



O:032/16 - ┤ ├ - File #5 FAULTS - 9
┤/├ - File #2 MAIN_PRGRM - 296
-( )- - File #2 MAIN_PRGRM - 295
T4:215.TT - ┤ ├ - File #2 MAIN_PRGRM - 294

Rung #296



T4:235.TT - ┤ ├ - File #2 MAIN_PRGRM - 294

Rung #297

```
       PALLET       PALLET                   PAUSE
AUTO   DETECTED     DETECTED                 PALLET IN
MODE   RIGHT SIDE   RIGHT SIDE               DWELL 5                          MOTOR 15
ENABLE DWELL 5      CARBON                   MOTOR 15                         SLOW
AUTO   SEN39        SEN42                    M15P05                           M15S
N7:37    I:037        I:053                    B3                             O:033
--] [------] [---------]/[-------------------]/[------------------------------( )--
  11       13           02                     407                              06
[158]                                          [628]
        |PALLET      |PALLET     PALLET
        |DETECTED    |DETECTED   DETECTED                              |MOTOR 15
        |LEFT SIDE   |LEFT SIDE  RIGHT SIDE                            |SLOW PULSE
        |CARBON      |DWELL 6    CARBON                                |M15SP
        |SEN40       |SEN43      SEN42                                 |+-TON------------+
        |  I:053     |  I:053      I:053                               +|TIMER ON DELAY   |-(EN)-
        +---] [--    +---] [--------] [--                               |TIMER:    T4:255 |
             00           03           02                               |BASE (SEC): 0.01|-(DN)
                                                                        |PRESET:      100 |
                                                                        |ACCUM:       100 |
 |MANUAL MOTOR                                                          +-----------------+
 |15 ON
 |MM15ON
 |  N7:23
 +---] [----------------------------
      13
 [525]
 |MOTOR 15   DOOR 7   DOOR 8
 |REVERSE    OPEN     OPEN
 |M15R       DROP7S   DROP8S
 |  B3       I:042    I:042
 +---] [------] [------] [----------
    115    |  01       03  |
 [582]     |               |
           |PALLET         |
           |DETECTED       |
           |LEFT SIDE      |
           |DWELL 5        |
           |SEN37          |
           |  I:037        |
           +----]/[--------+
                 11
O:033/06 - ] [ - File #2 MAIN_PRGRM - 299,300,306
           ]/[ - File #2 MAIN_PRGRM - 298
           ( ) - File #2 MAIN_PRGRM - 297
T4:255.TT - ] [ - File #2 MAIN_PRGRM - 294
```

Rung #298

```
                                                                   MOTOR 15
|MOTOR 15                                                          SLOW STOP
|SLOW                                                              PULSE
|M15S                                                              M15SSP
| O:033                                                            +-TON------------+
+--]/[-------------------------------------------------------------|TIMER ON DELAY  |-(EN)-
    06                                                             |TIMER:   T4:275 |
|[297]                                                             |BASE (SEC): 0.01|-(DN)
                                                                   |PRESET:      100|
                                                                   |ACCUM:         0|
                                                                   +----------------+
T4:275.TT - ] [ - File #2 MAIN_PRGRM - 294
```

Rung #299

```
AUTO                                PALLET                              CARBON
MODE                                DETECTED                            HI POWER
ENABLE   CARBON WATER OK            RIGHT SIDE  MOTOR 15                SUPPLY 1
AUTO     CAR_OK                     DWELL 5     SLOW                    OUTPUT
N7:37        B3                     SEN39       M15S                    CARPS1
-| |--------| |-------------------+--| |--------| |--+                  0:063
 11         279                   |  13          06  |                  --( )--
[158]      [727]                  |            [297] |                  12
                                  | PALLET           |
                                  | DETECTED         |  0:063/12 - -| |- - File #6 TECH_RUNGS - 6
                                  | LEFT SIDE        |  B3/835 - -| |- - File #2 MAIN_PRGRM - 620, 622
                                  | CARBON           |
                                  | SEN40            |                  CARBON
                                  |  I:053           |                  HI POWER
                                  +--| |-------------+                  SUPPLY 2
                                     00                                 OUTPUT
                                  PALLET                                CARPS2
                                  DETECTED                              0:063
                                  CENTER                                --( )--
                                  CARBON                                13
                                  SEN41
                                   I:053                                HIGH POWER
                                  --| |---                              CARBON 1 & 2
                                     01                                 TO THE FIX
                                                                        HIPRCAR1,2
                                                                        B3
                                                                        --( )--
                                                                        835
```

Rung #300

```
AUTO                                PALLET                              CARBON
MODE                                DETECTED                            HI POWER
ENABLE   CARBON WATER OK            LEFT SIDE  MOTOR 15                 SUPPLY 3
AUTO     CAR_OK                     CARBON     SLOW                     OUTPUT
N7:37        B3                     SEN40      M15S                     CARPS3
-| |--------| |-------------------+--| |-------| |--+                   0:063
 11         279                   |  I:053    0:033 |                   --( )--
[158]      [727]                  |  00        06   |                   14
                                  |          [297]  |
                                  |                 |  0:063/14 - -| |- - File #6 TECH_RUNGS - 6
                                  |                 |  B3/836 - -| |- - File #2 MAIN_PRGRM - 620, 622
                                  | PALLET          |
                                  | DETECTED        |                   CARBON
                                  | CENTER          |                   HI POWER
                                  | CARBON          |                   SUPPLY 4
                                  | SEN41           |                   OUTPUT
                                  |  I:053          |                   CARPS4
                                  +--| |------------+                   0:063
                                  |  01             |                   --( )--
                                  | PALLET          |                   15
                                  | DETECTED        |
                                  | RIGHT SIDE      |                   HIGH POWER
                                  | CARBON          |                   CARBON 3 & 4
                                  | SEN42           |                   TO THE FIX
                                  |  I:053          |                   HIPRCAR3,4
                                  +--| |------------+                   B3
                                     02                                 --( )--
                                                                        836
```

Rung #301

```
PALLET       PALLET
DETECTED     DETECTED
LEFT SIDE    RIGHT SIDE
BUFFER 3     BUFFER 3                                               CARBON TIMER
SEN34        SEN36                                                  CAR_TMR
 I:037        I:037                                                   T4:73
--| |----------| |--------------------------------------------------(RES)--
```

```
<
|     06         10                                                                      <
T4:73 - RTO - File #2 MAIN_PRGRM -  303                                                  |
        RES - File #2 MAIN_PRGRM -  301
Rung #302
|PALLET      PALLET     PALLET                                                           |
|DETECTED    DETECTED   DETECTED                                                         |
|LEFT SIDE   CENTER     RIGHT SIDE                                                       |
|DWELL 5     DWELL 5    DWELL 5                                         CARBON TRANSIT   |
|SEN37       SEN38      SEN39                                           CAR_TRAN         |
|  I:037       I:037      I:037                                               B3         |
|----] [-------] [--------] [---------------------------------------------------(L)------|
|    11          12         13                                                92         |
B3/92 - ] [ - File #2 MAIN_PRGRM -  303
      -(L)- - File #2 MAIN_PRGRM -  302
      -(U)- - File #2 MAIN_PRGRM -  304
Rung #303
|CARBON TRANSIT                                                CARBON TIMER              |
|CAR_TRAN                                                      CAR_TMR                   |
|        B3                                                    +-RTO--------------+      |
|-------] [-----------------------------------------------------|RETENTIVE TIMER ON|-(EN)-|
|        92                                                    |TIMER:       T4:73|      |
|[302]                                                         |BASE (SEC):    1.0|-(DN) |
|                                                              |PRESET:       1000|      |
|                                                              |ACCUM:           6|      |
|                                                              +------------------+      |
T4:73 - RTO - File #2 MAIN_PRGRM -  303
        RES - File #2 MAIN_PRGRM -  301
Rung #304
|PALLET      PALLET     PALLET                                                           |
|DETECTED    DETECTED   DETECTED                                                         |
|LEFT SIDE   CENTER     RIGHT SIDE                                                       |
|DWELL 6     DWELL 6    DWELL 6                                         CARBON TRANSIT   |
|SEN43       SEN44      SEN45                                           CAR_TRAN         |
|  I:053       I:053      I:053                                               B3         |
|----] [-------] [--------] [---------------------------------------------------(U)------|
|    03          04         05                                                92         |
B3/92 - ] [ - File #2 MAIN_PRGRM -  303
      -(L)- - File #2 MAIN_PRGRM -  302
      -(U)- - File #2 MAIN_PRGRM -  304
Rung #305
|              MOTOR DRIVE                                                 MOTOR 16      |
|              PULSER                                                      INTERRUPT     |
|  M16SP       MDP                                                         M16I          |
|  T4:216          B3                                                        O:032       |
|--+--] [---+------] [----------------------------------------------------------( )------|
|  |   TT   |      299                                                         07        |
|  |[306]   | [14]                                                                       |
|  |M16FSP  |                                                                            |
|  | T4:236 |                                                                            |
|  |--] [---|                                                                            |
|  |   TT   |                                                                            |
|  |[307]   |                                                                            |
|  |M16SSP  |                                                                            |
|  | T4:276 |                                                                            |
|  +--] [---+                                                                            |
|      TT                                                                                 |
|   [308]                                                                                 |
```

284

```
Rung #306
        PALLET
AUTO    DETECTED
MODE    RIGHT SIDE    MOTOR 15                                                   MOTOR 16   MOTOR 16
ENABLE  DWELL 5       SLOW                                                       REVERSE    FAST
AUTO    SEN39         M15S                                                       M16R       M16F
N7:37    I:037        O:033                                                      B3         O:032
--] [------] [----------] [-------------------------------------------------------]/[--------( )---
  11        13            06                                                     116        17
[158]                   [297]                                                    [583]
        PALLET                    O:032/17 - ] [ - File #5 FAULTS - 10
        DETECTED                             ]/[ - File #2 MAIN_PRGRM - 307
        LEFT SIDE                 O:033/07 - ]/[ - File #2 MAIN_PRGRM - 308
        CARBON                    T4:216.TT - ] [ - File #2 MAIN_PRGRM - 305
        SEN40          MOTOR 17                                                  MOTOR 16
         I:053         SLOW                                                      SLOW
        --] [--        M17S                                                      M16S
          00            O:063                                                     O:033
                       --] [--                                                   --( )--
        PALLET           00                                                        07
        DETECTED       [312]
        CENTER
        CARBON                                                                   MOTOR 16
        SEN41                                                                    SLOW PULSE
         I:053                                                                   M16SP
        --] [--                                                                  +-TON-----------------+
          01                                                                     |TIMER ON DELAY       |-(EN)-
                                                                                 |TIMER:       T4:216  |
        PALLET                                                                   |BASE (SEC):    0.01  |-(DN)
        DETECTED                                                                 |PRESET:         100  |
        RIGHT SIDE                                                               |ACCUM:          100  |
        CARBON                                                                   +---------------------+
        SEN42
         I:053
        --] [--
          02
MANUAL MOTOR
16 ON
MM16ON
   N7:23
--] [--
   14
[526]
MOTOR 16
REVERSE
M16R
   B3
--] [--
   116
[583]
Rung #307
MOTOR 16                                                                          MOTOR 16
FAST                                                                              FAST STOP
M16F                                                                              PULSE
 O:032                                                                            M16FSP
                                                                                  +-TON-----------------+
--]/[-----------------------------------------------------------------------------|TIMER ON DELAY       |-(EN)-
  17                                                                              |TIMER:       T4:236  |
[306]                                                                             |BASE (SEC):    0.01  |-(DN)
                                                                                  |PRESET:         100  |
                                                                                  |ACCUM:            0  |
                                                                                  +---------------------+
```

```
T4:236.TT - -| |- - File #2 MAIN_PRGR.     305
Rung #308
|                                                                    MOTOR 16           |
|MOTOR 16                                                            SLOW STOP          |
|SLOW                                                                PULSE              |
|M16S                                                                M16SSP             |
| O:033                                                              +-TON-----------+  |
|---|/|--------------------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|    07                                                              |TIMER:   T4:276|  |
|[306]                                                               |BASE (SEC): 0.01+-(DN) |
|                                                                    |PRESET:     100|  |
|                                                                    |ACCUM:        0|  |
|                                                                    +---------------+  |
T4:276.TT - -| |- - File #2 MAIN_PRGRM -  305
Rung #309
|               MOTOR DRIVE                                                MOTOR 17     |
|               PULSER                                                     INTERRUPT    |
|  M17FP        MDP                                                        M17I         |
|  T4:217       B3                                                           O:062      |
|-+---| |----+-----| |------------------------------------------------------( )-------|
| |   TT     |     299                                                        00        |
| |[310]     |  [14]                                                                    |
| |M17FSP    |                                                                          |
| | T4:237   |                                                                          |
| |---| |----|                                                                          |
| |   TT     |                                                                          |
| |[311]     |                                                                          |
| |M17SP     |                                                                          |
| |T4:257    |                                                                          |
| |---| |----|                                                                          |
| |   TT     |                                                                          |
| |[312]     |                                                                          |
| |M17SSP    |                                                                          |
| | T4:277   |                                                                          |
| +---| |----+                                                                          |
|     TT                                                                                |
|  [313]                                                                                |
```

```
Rung #310
|
|                PALLET       PALLET                                   PAUSE
| AUTO           DETECTED     DETECTED                                 PALLET IN
| MODE           RIGHT SIDE   RIGHT SIDE                               DWELL 6    MOTOR 17             MOTOR 17
| ENABLE         CARBON       DWELL 6                                  MOTOR 17   REVERSE              FAST
| AUTO           SEN42        SEN45                                    M17PD06    M17R                 M17F
|  N7:37           I:053        I:053                                    B3         B3                  O:062
|---] [-------+----] [----+-------]/[------------------------+------+------]/[-------]/[--------+----------( )---------+
| |  11       |  | 02     |       05                        | |    408        117             |          10        | |
| |[158]      |  |        |                                  | |  [628]      [584]             |                    | |
| |           |  |PALLET  |                                  | |                                |                    | |
| |           |  |DETECTED|                                  | |                                |MOTOR 17            | |
| |           |  |LEFT SIDE                                  | |                                |FAST PULSE          | |
| |           |  |DWELL 6 |                                  | |                                |M17FP               | |
| |           |  |SEN43   |                                  | |                                | +--TON---------+   | |
| |           |  |  I:053 |                                  | |                                +-|TIMER ON DELAY|-(EN)-+
| |           |  +---] [--+                                  | |                                  |TIMER:  T4:217|
| |           |      03                                      | |                                  |BASE (SEC): 0.01|-(DN)
| |           |                                              | |                                  |PRESET:    100|
| |           |                    PALLET     PALLET    PALLET | |                                  |ACCUM:       0|
| |           |                    DETECTED   DETECTED  DETECTED | |                                +--------------+
| |           |DOOR 9   DOOR 10    RIGHT SIDE LEFT SIDE RIGHT SIDE | |
| |           |OPEN     OPEN       DWELL 6    EXBUFFER  EXBUFFER   | |
| |           |DROP9S   DROP10S    SEN45      SEN49     SEN51      | |
| |           | I:056    I:056      I:053      I:053     I:053     | |
| |           +---] [-----] [--------] [--------]/[-------]/[------+ |
| |              01       03         05         11        13         |
| |MANUAL MOTOR     DOOR 9   DOOR 10                                 |
| |17 ON            OPEN     OPEN                                    |
| |MM17ON           DROP9S   DROP10S                                 |
| |   N7:23          I:056    I:056                                  |
| +----] [-------+----] [------] [----+------------------------------+
|        15      |    01       03     |
|  [527]         |                    |
|                |PALLET              |
|                |DETECTED            |
|                |RIGHT SIDE          |
|                |BUFFER 4            |
|                |SEN48               |
|                |    I:053           |
|                +-----]/[------------+
|                      10
O:062/10 - ] [ - File #5 FAULTS -  11
           ]/[ - File #2 MAIN_PRGRM -  311
           -( )- - File #2 MAIN_PRGRM -  310
T4:217.TT - ] [ - File #2 MAIN_PRGRM -  309
Rung #311
|                                                                     MOTOR 17
|MOTOR 17                                                             FAST STOP
|FAST                                                                 PULSE
|M17F                                                                 M17FSP
|  O:062                                                              +--TON----------+
|---]/[---------------------------------------------------------------|TIMER ON DELAY |-(EN)-
|   10                                                                |TIMER:   T4:237|
|[310]                                                                |BASE (SEC): 0.01|-(DN)
|                                                                     |PRESET:     100|
|                                                                     |ACCUM:      102|
|                                                                     +---------------+
T4:237.TT - ] [ - File #2 MAIN_PRGRM -  309
```

Rung #321

```
|                                                              MOTOR 19
|MOTOR 19                                                      FAST STOP
|FAST                                                          PULSE
|M19F                                                          M19FSP
|  O:062                                                       +--TON----------------+
|--|/|---------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|   12                                                         |TIMER:         T4:239|
|[320]                                                         |BASE (SEC):      0.01+-(DN)
|                                                              |PRESET:           100|
|                                                              |ACCUM:              0|
|                                                              +---------------------+
T4:239.TT - -| |- - File #2 MAIN_PRGRM - 319
```

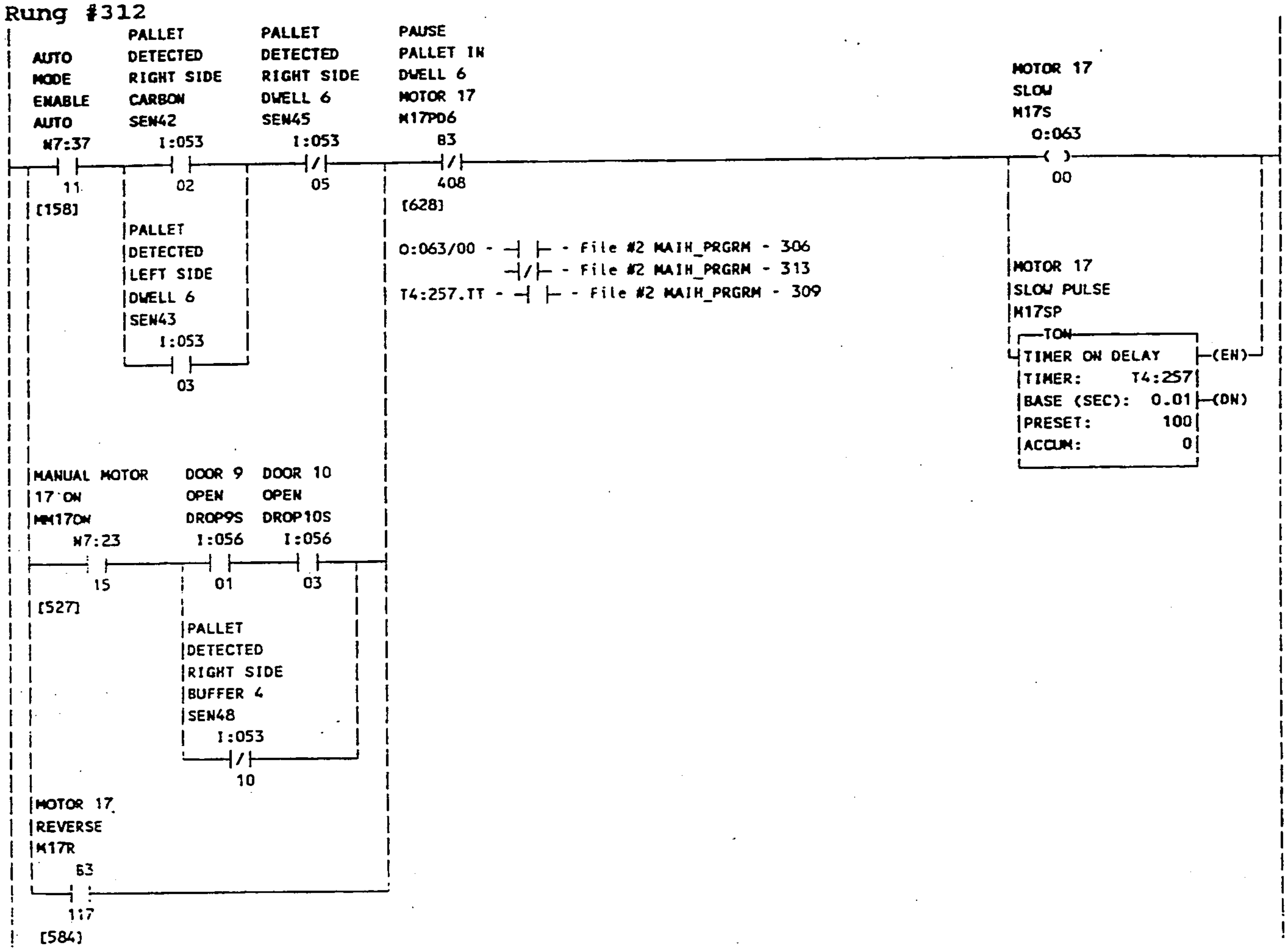
Rung #322

```
|                                  PAUSE
|                                  PALLET IN
| MANUAL MOTOR   DOOR 11           EXITBUFFER                  MOTOR 19
| 19 ON          OPEN              MOTOR 19                    SLOW
| MM19ON         DROP11S           M19PXB                      M19S
|      N7:24        I:056            B3                          O:063
|------| |----------| |------------|/|-------------------------+--( )--
|       1            05            409                         |   02
| [529]                            [628]
|                |PALLET
|                |DETECTED         O:063/02 - -|/|- - File #2 MAIN_PRGRM - 323
|                |RIGHT SIDE       T4:259.TT - -| |- - File #2 MAIN_PRGRM - 319
|                |EXBUFFER                                     |MOTOR 19
|                |SEN51                                        |SLOW PULSE
|                |   I:053                                     |M19SP
|                +---|/|---                                    +--TON----------------+
|                     13                                       +TIMER ON DELAY       +-(EN)-
|                                                              |TIMER:         T4:259|
|                                                              |BASE (SEC):      0.01+-(DN)
|                                                              |PRESET:           100|
|                                                              |ACCUM:              0|
| |MOTOR 19    DOOR 9   DOOR 10                                +---------------------+
| |REVERSE     OPEN     OPEN
| |M19R        DROP9S   DROP10S
| |   B3        I:056     I:056
| +---| |--------| |-------| |---
|    119          01        03
|  [586]
|             |PALLET
|             |DETECTED
|             |LEFT SIDE
|             |EXBUFFER
|             |SEN49
|             |   I:053
|             +---|/|---
|                  11
```

Rung #323

```
|                                                              MOTOR 19
|MOTOR 19                                                      SLOW STOP
|SLOW                                                          PULSE
|M19S                                                          M19SSP
|  O:063                                                       +--TON----------------+
|--|/|---------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|   02                                                         |TIMER:         T4:279|
|[322]                                                         |BASE (SEC):      0.01+-(DN)
|                                                              |PRESET:           100|
|                                                              |ACCUM:            101|
|                                                              +---------------------+
T4:279.TT - -| |- - File #2 MAIN_PRGRM - 319
```

Rung #312



Rung #313

```
Rung #314
|            MOTOR DRIVE                                   MOTOR 18 |
|            PULSER                                       INTERRUPT |
|  M18FP     MDP                                               M18I |
|  T4:218        B3                                           O:062 |
|-+--] [--+-------] [----------------------------------------( )----|
| |   TT   |     299                                            01   |
| |[315]   |  [14]                                                  |
| |M18FSP  |                                                        |
| | T4:238 |                                                        |
| |--] [---|                                                        |
| |   TT   |                                                        |
| |[316]   |                                                        |
| |M18SP   |                                                        |
| |T4:258  |                                                        |
| |--] [---|                                                        |
| |   TT   |                                                        |
| |[317]   |                                                        |
| |M18SSP  |                                                        |
| | T4:278 |                                                        |
| +--] [---+                                                        |
|     TT                                                            |
|  [318]                                                            |
```

Rung #315

```
                                        PALLET         PALLET
 AUTO                                   DETECTED       DETECTED                                                          MOTOR 18
 MODE      DOOR 9   DOOR 10             RIGHT SIDE     RIGHT SIDE     STOP MOTOR 18  MOTOR 18                            FAST
 ENABLE    OPEN     OPEN                DWELL 6        EXBUFFER       PAUSE LATCH    REVERSE                             M18F
 AUTO      DROP9S   DROP10S             SEN45          SEN51          M18PL          M18R                                 O:062
  N7:37    I:056    I:056                  I:053          I:053            B3             B3
--| |------| |------| |------------------| |-------------|/|-------------|/|-----------|/|---------------------------+----( )----+
   11       01       03                    05             13               477            118                            11
 [158]                                                                 [629]          [585]
                                        PALLET
                                        DETECTED                                                                    MOTOR 18
                                        LEFT SIDE                                                                   FAST PULSE
                                        BUFFER 4                                                                    M18FP
                                        SEN46                                                                        +-TON-----------------+
                                           I:053                                                                    +-TIMER ON DELAY      +-(EN)-
                                        ---| |---                                                                    TIMER:        T4:218
                                           06                                                                        BASE (SEC):     0.01 +-(DN)
                                                                                                                     PRESET:          100
                                        PALLET                                                                       ACCUM:             0
                                        DETECTED
                                        RIGHT SIDE
                                        BUFFER 4
                                        SEN48
                                           I:053
                                        ---| |---
                                           10
 MANUAL MOTOR      DOOR 9   DOOR 10
 18 ON             OPEN     OPEN
 MM18ON            DROP9S   DROP10S
   N7:24           I:056    I:056
 ---| |------------| |------| |--------------------
     0              01       03
 [528]
                   PALLET
                   DETECTED
                   RIGHT SIDE
                   BUFFER 4
                   SEN48
                      I:053
                   ---|/|---
                      10
```

```
O:062/11 - -| |- - File #5 FAULTS -  12
           -|/|- - File #2 MAIN_PRGRM -  316
           -( )- - File #2 MAIN_PRGRM -  315
T4:218.TT - -| |- - File #2 MAIN_PRGRM -  314
```

Rung #316

```
                                                                                                    MOTOR 18
 MOTOR 18                                                                                           FAST STOP
 FAST                                                                                               PULSE
 M18F                                                                                               M18FSP
  O:062                                                                                             +-TON-----------------+
--|/|-----------------------------------------------------------------------------------------------+-TIMER ON DELAY      +-(EN)-
   11                                                                                                TIMER:        T4:238
 [315]                                                                                               BASE (SEC):     0.01 +-(DN)
                                                                                                     PRESET:          100
                                                                                                     ACCUM:           102
```

```
T4:238.TT - -| |- - File #2 MAIN_PRGRM -  314
```

Rung #317

MANUAL MOTOR 18 ON MM18ON N7:24 0 [528]

DOOR 9 OPEN DROP9S I:056 01

DOOR 10 OPEN DROP10S I:056 03

PALLET DETECTED RIGHT SIDE BUFFER 4 SEN48 I:053 10

MOTOR 18 REVERSE M18R B3 118 [585]

0:063/01 - -|/|- - File #2 MAIN_PRGRM - 318
T4:258.TT - -| |- - File #2 MAIN_PRGRM - 314

MOTOR 18 SLOW M18S 0:063 ( ) 01

MOTOR 18 SLOW PULSE M18SP

TON
TIMER ON DELAY (EN)
TIMER: T4:258
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

Rung #318

MOTOR 18 SLOW M18S 0:063 -|/|- 01 [317]

T4:278.TT - -| |- - File #2 MAIN_PRGRM - 314

MOTOR 18 SLOW STOP PULSE M18SSP

TON
TIMER ON DELAY (EN)
TIMER: T4:278
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 101

Rung #319

M19FP T4:219 TT [320]

M19FSP T4:239 TT [321]

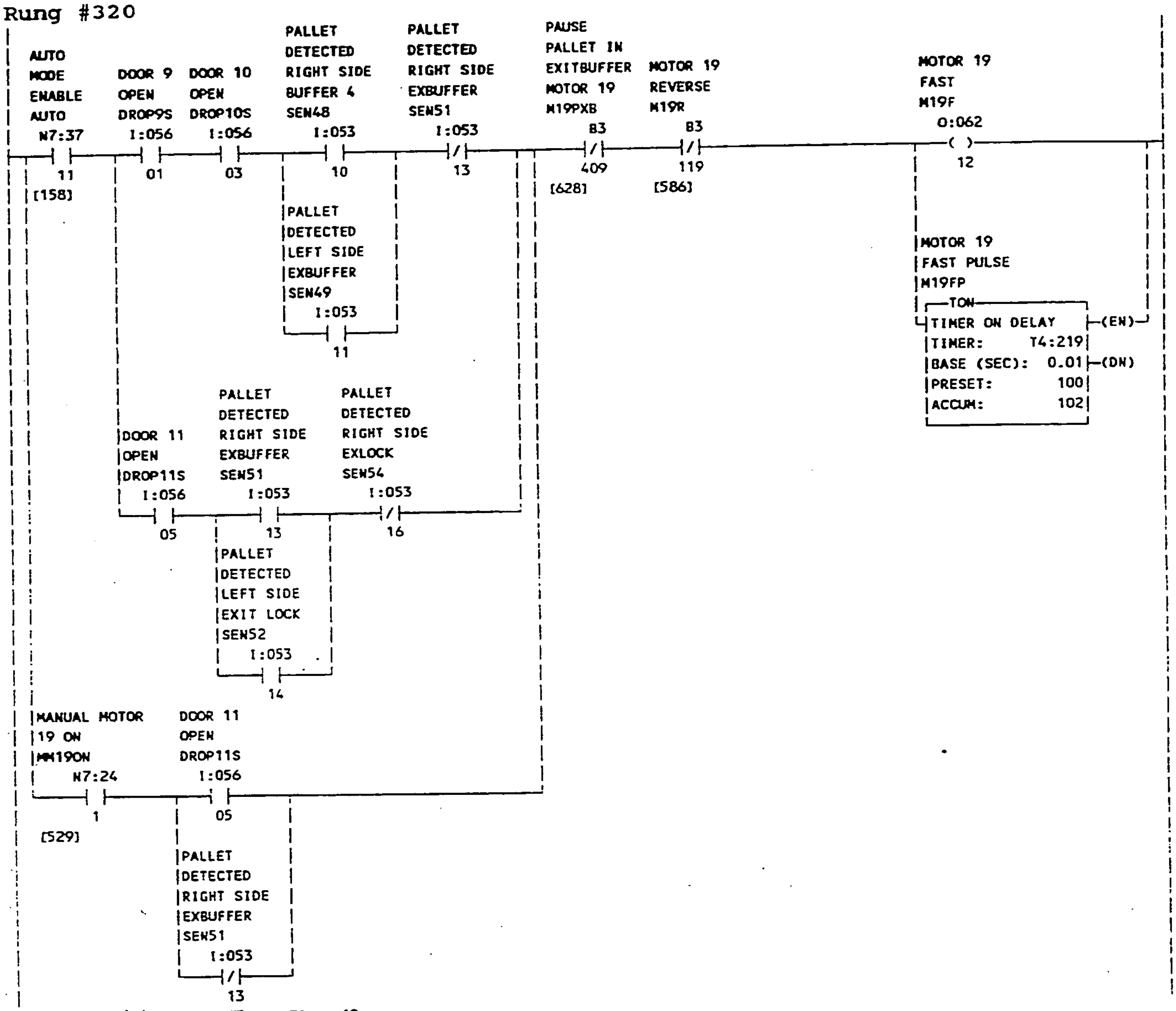
M19SP T4:259 TT [322]

M19SSP T4:279 TT [323]

MOTOR DRIVE PULSER MDP B3 299 [14]

MOTOR 19 INTERRUPT M19I 0:062 ( ) 02

Rung #320



O:062/12 - -| |- - File #5 FAULTS - 12
-|/|- - File #2 MAIN_PRGRM - 321
-( )- - File #2 MAIN_PRGRM - 320
T4:219.TT - -| |- - File #2 MAIN_PRGRM - 319

```
Rung #324
| PUMPDOWN                                                                                       EXITLOCK          |
| SYSTEM                                                                                         HIVAC BAFFLE      |
| ENABLE                                                                                         ENABLE            |
| PDSE                                                                                           HV12_3            |
|     B3                                                                                            O:061          |
|----] [----------------------------------------------------------------------------------------------(L)----------|
| |  303                                          |                                               |     17      | |
| | [23]                                          |                                               |             | |
| |                                               | O:061/17 - -(U)- - File #2 MAIN_PRGRM - 139   |             | |
| |                                               | T4:39.DN - -] [- - File #2 MAIN_PRGRM - 326   |             | |
| |          PALLET                  PALLET       |                                               |DOOR 10      | |
| |AUTO      DETECTED                DETECTED     |                                               |DELAY TIMER  | |
| |MODE      CENTER      DOOR 11     RIGHT SIDE   |                                               |DR10DT       | |
| |ENABLE    DWELL 6     CLOSED      EXBUFFER     |                                               |+-TON-------+| |
| |AUTO      SEN44       DRCL11S     SEN51        |                                               +|TIMER ON DELAY |-(EN)-+
| | N7:37     I:053       I:056       I:053       |                                                |TIMER:     T4:39|     |
| |---] [-------] [---------] [---------]/[-------|                                                |BASE (SEC):  1.0|-(DN)|
| |   11        04          04          13        |                                                |PRESET:        5|     |
| |[158]                                          |                                                |ACCUM:         0|     |
| |                                               |                                                +----------------+     |
| |SYSTEM                                         |                                                                      |
| |VENT                                           |                                                                      |
| |ENABLE                                         |                                                                      |
| |SYSVNTE                                        |                                                                      |
| | N7:37                                         |                                                                      |
| +---] [-----------------------------------------+                                                                      |
|      5                                                                                                                 |
| [368]                                                                                                                  |
Rung #325
|                                                                                           DOOR OPEN                    |
| PREPARE FOR  DOOR 9                                                                       SOLENOID                     |
| AUTO RUN     OPEN                                                                         9 ENABLE                     |
| >AUTO        DROP9S                                                                       DROP9                        |
|     N7:37      I:056                                                                         O:061                     |
|-------] [--------]/[------------------------------------------------------------------------( )----------------------|
| |      1         01                       |                                             |    01                    | |
| | [162]                                   |                                             |                          | |
| |                                         | O:061/01 - -] [- - File #2 MAIN_PRGRM - 325 |MANUAL                    | |
| |                                         |                    File #5 FAULTS - 57      |CONTROL   DOOR OPEN   MANUAL| |
| |MANUAL        EXIT BUFFER  CARBON        |                    File #6 TECH_RUNGS - 3   |OPEN DOOR SOLENOID    DOOR 9| |
| |CONTROL       CHAMBER      CHAMBER       | N7:32/15 - -(U)- - File #2 MAIN_PRGRM - 329 |9         9 ENABLE    OPEN  | |
| |OPEN DOOR     =<250        =<250         | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 |M-DROP9   DROP9       MDR9OP| |
| |9             MICRONS      MICRONS       | N7:32/3 - -(L)- - File #2 MAIN_PRGRM - 329  | N7:11     O:061       N7:32 | |
| |M-DROP9       PIR15        PIR16         | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 +---] [-------] [-------+-(L)-+ |
| |  N7:11         I:040        I:054       |                                               15        01       | 15  |   |
| +---] [------+-----] [--------] [---------+                                             [3]       [325]      |     |   |
|      15      |       13           07      |                                                                  |MANUAL|  |
|  [3]         |                            |                                                                  |DOOR 9|  |
|              |EXIT BUFFER  CARBON         |                                                                  |CLOSE |  |
|              |CHAMBER      CHAMBER        |                                                                  |MDR9CL|  |
|              |=<250        =<250          |                                                                  | N7:32|  |
|              |MICRONS      MICRONS        |                                                                  +-(U)--+  |
|              |PIR15        PIR16          |                                                                     3      |
|              |  I:040        I:054        |                                                                            |
|              +----]/[--------]/[----------+                                                                            |
|                   13           07                                                                                      |
```

Rung #326

DOOR 9 DELAY DR10DT T4:39 DN [324]
PAUSE LATCH ENABLE PLE N7:37 3 [625]
DOOR 10 OPEN DROP10S I:056 03
DOOR OPEN SOLENOID 10 ENABLE DROP10 O:061 03

PUMPDOWN SYSTEM ENABLE PDSE B3 303 [23]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
PSENDPULSE T4:128 TT [454]

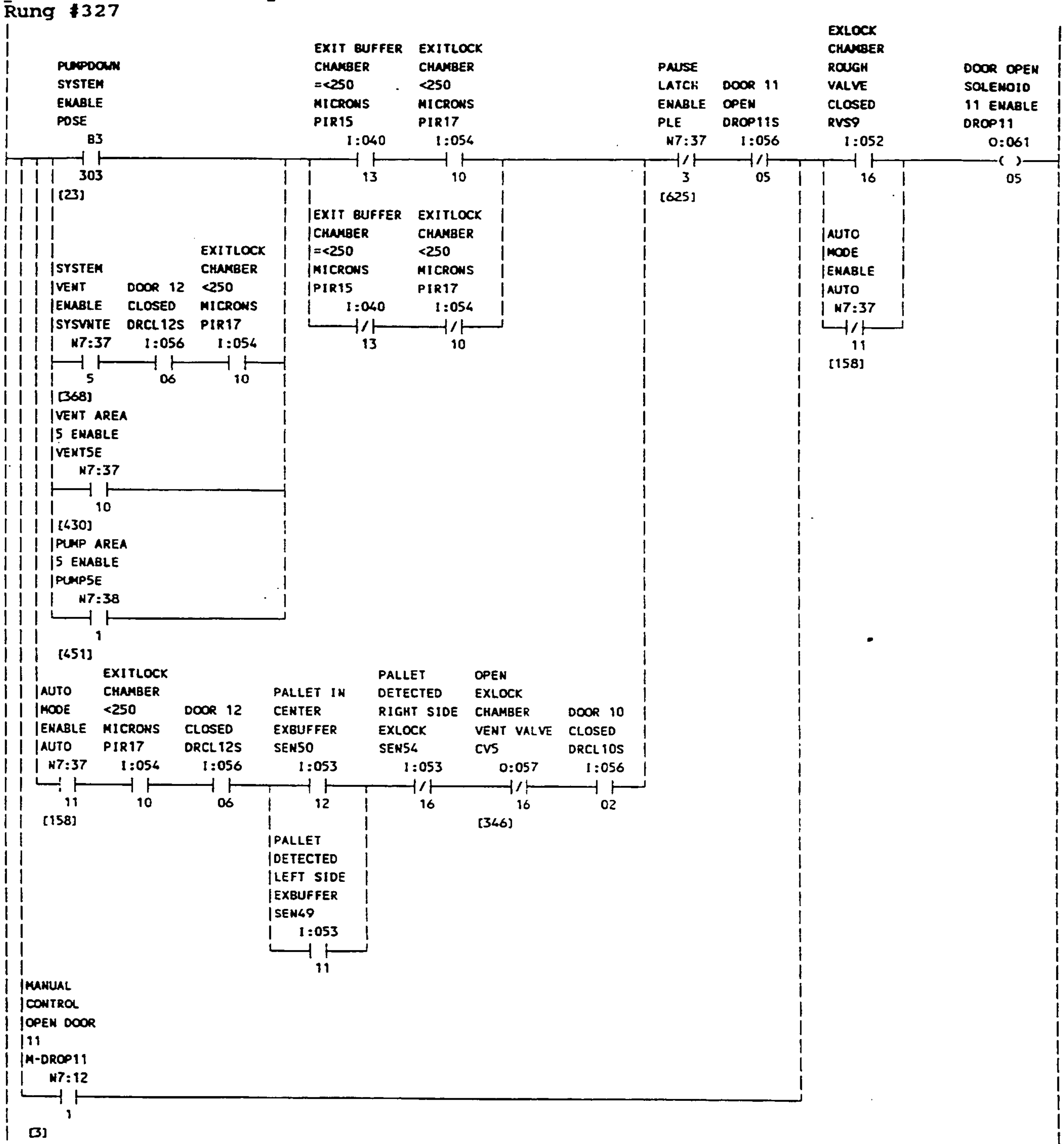
MANUAL CONTROL OPEN DOOR 10 M-DROP10 N7:12 0 [3]
EXIT BUFFER CHAMBER =<250 MICRONS PIR15 I:040 13
CARBON CHAMBER =<250 MICRONS PIR16 I:054 07
EXIT BUFFER CHAMBER =<250 MICRONS PIR15 I:040 13
CARBON CHAMBER =<250 MICRONS PIR16 I:054 07

MANUAL CONTROL OPEN DOOR 10 M-DROP10 N7:12 0 [3]
DOOR OPEN SOLENOID 10 ENABLE DROP10 O:061 03 [326]
MANUAL DOOR 10 OPEN MDR10OP N7:33 (L) 0
MANUAL DOOR 10 CLOSE MDR10CL N7:32 (U) 4

O:061/03 - -| |- - File #2 MAIN_PRGRM - 326
File #5 FAULTS - 59
File #6 TECH_RUNGS - 3
-( )- - File #2 MAIN_PRGRM - 326
N7:33/0 - -(L)- - File #2 MAIN_PRGRM - 326
-(U)- - File #2 MAIN_PRGRM - 335
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
N7:32/4 - -(L)- - File #2 MAIN_PRGRM - 335
-(U)- - File #2 MAIN_PRGRM - 326

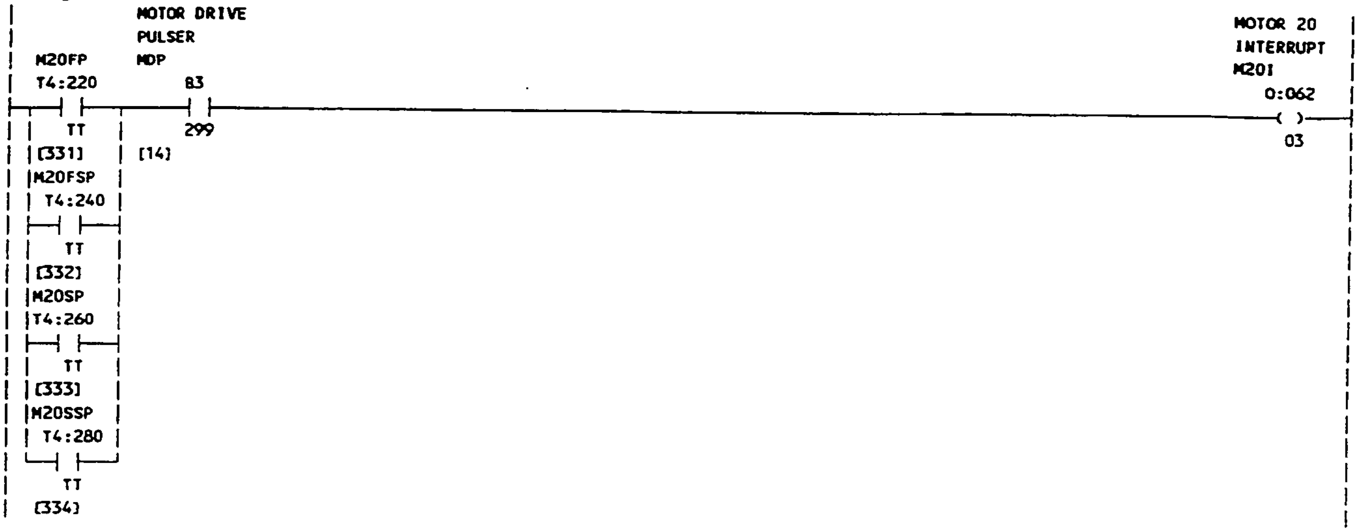
_F:N7:21LX21 - BTW - File #2 MAIN_PRG 2

Rung #327

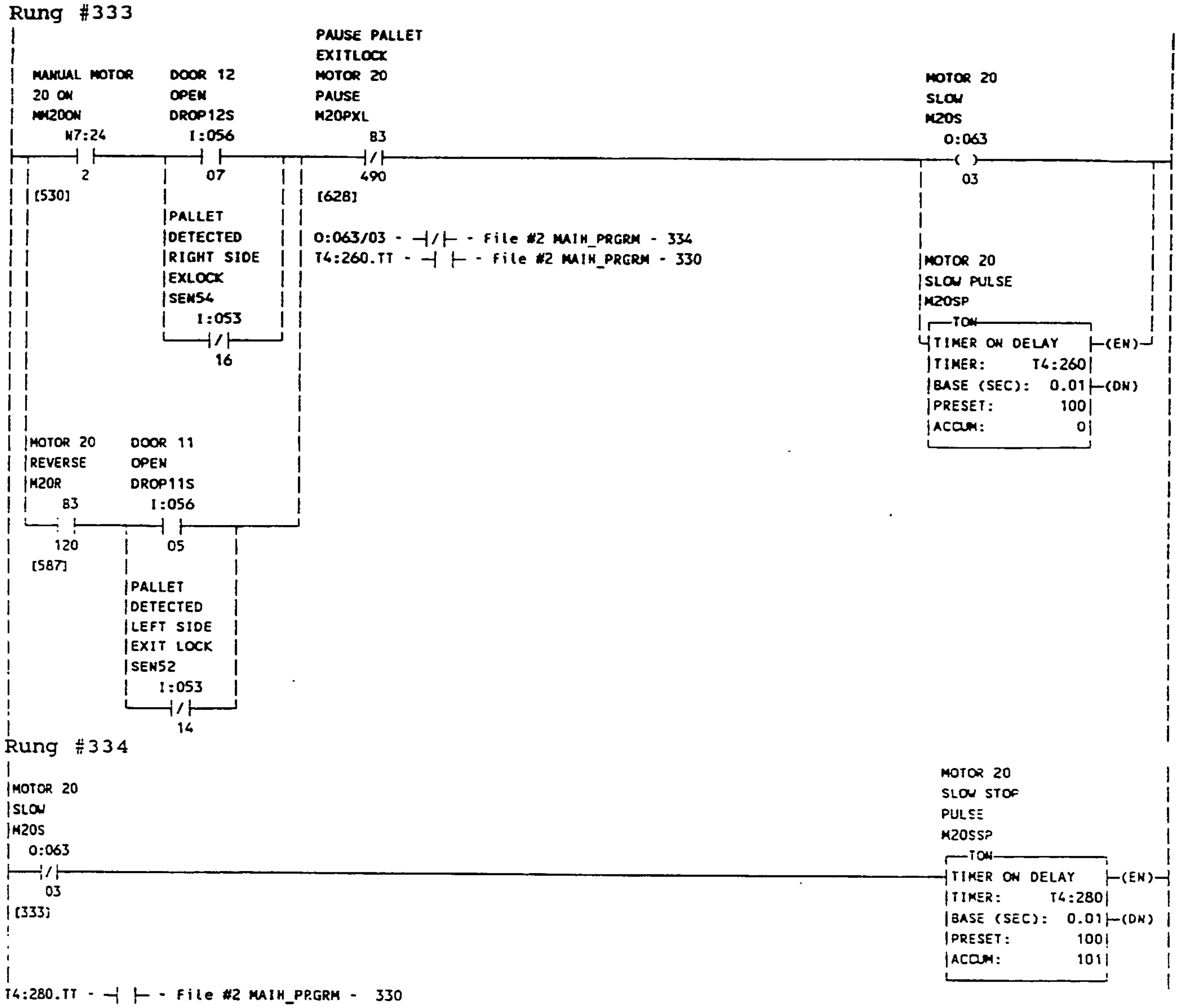


```
O:061/05 - -| |- - File #5 FAULTS - (
                   File #6 TECH_RUNGS - 3
           -( )- - File #2 MAIN_PRGRM - 327
Rung #328
         PALLET       PALLET
 PALLET IN   DETECTED     DETECTED                                        PALLET AT
 CENTER      RIGHT SIDE   LEFT SIDE                                       DOOR 9 AND 10
 BUFFER 4    BUFFER 4     EXBUFFER                                        PLT_DR9,10
 SEN47       SEN48        SEN49                                            B3
   I:053       I:053        I:053
|--+---| |---+-----| |--------| |---------------------------------------------( )---|
   |   07    |     10           11                                          298
   |         | B3/298 - -|/|- - File #2 MAIN_PRGRM - 329, 335
   |PALLET IN|
   |CENTER   |
   |EXBUFFER |
   |SEN50    |
   |  I:053  |
   +---| |---+
       12
Rung #329
 MANUAL                                                    CLOSE
 CONTROL                                                   DOOR 9
 CLOSE DOOR   PALLET AT                                    SOLENOID
 9            DOOR 9 AND 10                                ENABLE
 M-DRCL9      PLT_DR9,10                                   DRCL9
   N7:11        B3                                          O:061
|--+---| |---+-----|/|-----------------------------------+-----( )------------+
   |   3     |     298                                   |     00             |
   | [3]     | [328]                                     |                    |
   |         |                                           |MANUAL              |
   |         | O:061/00 - -| |- - File #5 FAULTS - 33    |CONTROL             MANUAL
   |         |          File #6 TECH_RUNGS - 3           |CLOSE DOOR PALLET AT DOOR 9
   |         | N7:32/15 - -(L)- - File #2 MAIN_PRGRM - 325 |9        DOOR 9 AND 10 OPEN
   |VENT AREA| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  |M-DRCL9  PLT_DR9,10  MDR9OP
   |4 ENABLE | N7:32/3 - -(U)- - File #2 MAIN_PRGRM - 325   |  N7:11     B3       N7:32
   |VENT4E   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  +---| |-------|/|---+--(U)--+
   |  N7:37  |                                                 3        298    |  15
   +---| |---+                                                [3]      [328]   |
       9                                                                      |MANUAL
   [425]                                                                      |DOOR 9
                                                                              |CLOSE
                                                                              |MDR9CL
                                                                              | N7:32
                                                                              +--(L)--
                                                                                  3
```

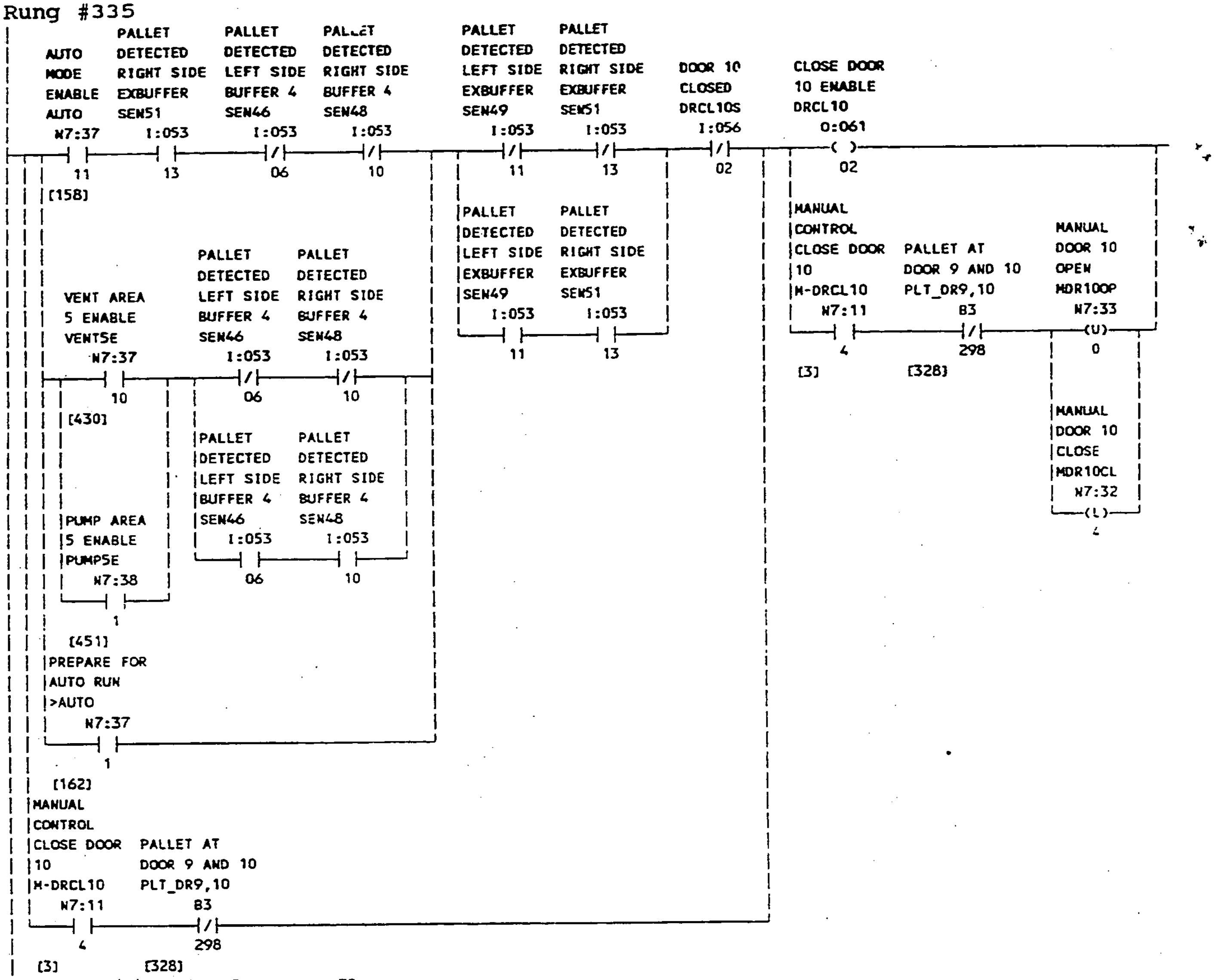
Rung #330


MOTOR DRIVE
PULSER
MDP
B3
299
[14]
M20FP
T4:220
TT
[331]
M20FSP
T4:240
TT
[332]
M20SP
T4:260
TT
[333]
M20SSP
T4:280
TT
[334]
MOTOR 20
INTERRUPT
M20I
O:062
03

```
Rung #331
|                           PALLET        PALLET                  PAUSE PALLET
| AUTO                      DETECTED      DETECTED                EXITLOCK
| MODE       DOOR 11        RIGHT SIDE    RIGHT SIDE              MOTOR 20      MOTOR 20                        MOTOR 20
| ENABLE     OPEN           EXBUFFER      EXLOCK                  PAUSE         REVERSE                         FAST
| AUTO       DROP11S        SEN51         SEN54                   M20PXL        M20R                            M20F
|  N7:37       I:056         I:053          I:053                     B3            B3                          O:062
|-+--] [-----+--] [--+------] [---+---------]/[-----+-+----------]/[-----------]/[---------------------------+---( )---+-|
| |   11     |   05  |      13    |         16      | |          490           120                          |   13     | |
| |[158]     |       |            |                 | |[628]            [587]                               |          | |
| |          |       |PALLET      |                 | |                                                     |          | |
| |          |       |DETECTED    |                 | |                                                     |          | |
| |          |       |LEFT SIDE   |                 | |                                                     |MOTOR 20  | |
| |          |       |EXIT LOCK   |                 | |                                                     |FAST PULSE| |
| |          |       |SEN52       |                 | |                                                     |M20FP     | |
| |          |       |  I:053     |                 | |                                                     |+--TON---------------+  | |
| |          |       +---] [------+                 | |                                                     +|TIMER ON DELAY      |-(EN)-+
| |          |           14                         | |                                                      |TIMER:      T4:220  |      |
| |          |                                      | |                                                      |BASE (SEC):   0.01  |-(DN) |
| |          |              PALLET      PALLET      | |                                                      |PRESET:        100  |      |
| |          |              DETECTED    DETECTED    | |                                                      |ACCUM:           0  |      |
| |          |DOOR 12 DOOR 11 RIGHT SIDE RIGHT SIDE | |                                                      +--------------------+      |
| |          |OPEN    CLOSED  EXLOCK     EXIT END   | |                                                                                  |
| |          |DROP12S DRCL11S SEN54      SEN57      | |                                                                                  |
| |          | I:056   I:056   I:053      I:054     | |                                                                                  |
| |          +--] [-----] [-----] [--------]/[------+ |                                                                                  |
| |            07      04      16         17          |                                                                                  |
| |MANUAL MOTOR    DOOR 12                            |                                                                                  |
| |20 ON           OPEN                               |                                                                                  |
| |MM20ON          DROP12S                            |                                                                                  |
| |   N7:24         I:056                             |                                                                                  |
| +----] [-----+-----] [-----+------------------------+                                                                                  |
|       2      |      07     |                                                                                                           |
| [530]        |             |                                                                                                           |
|              |PALLET       |                                                                                                           |
|              |DETECTED     |                                                                                                           |
|              |RIGHT SIDE   |                                                                                                           |
|              |EXLOCK       |                                                                                                           |
|              |SEN54        |                                                                                                           |
|              |   I:053     |                                                                                                           |
|              +----]/[------+                                                                                                           |
|                   16                                                                                                                   |
O:062/13 - ] [ - - File #5 FAULTS -   13
           ]/[ - - File #2 MAIN_PRGRM -   332
           -( )- - File #2 MAIN_PRGRM -   331
T4:220.TT - ] [ - - File #2 MAIN_PRGRM -   330
Rung #332
|                                                                                                  MOTOR 20              |
|MOTOR 20                                                                                          FAST STOP             |
|FAST                                                                                              PULSE                 |
|M20F                                                                                              M20FSP                |
|  O:062                                                                                          +--TON---------------+ |
|---]/[-------------------------------------------------------------------------------------------|TIMER ON DELAY      |-(EN)-|
|    13                                                                                           |TIMER:      T4:240  |      |
|[331]                                                                                            |BASE (SEC):   0.01  |-(DN) |
|                                                                                                 |PRESET:        100  |      |
|                                                                                                 |ACCUM:         102  |      |
|                                                                                                 +--------------------+      |
T4:240.TT - ] [ - - File #2 MAIN_PRGRM -   330
```


Rung #333
MANUAL MOTOR 20 ON MM20ON
N7:24
2
[530]
DOOR 12 OPEN DROP12S
I:056
07
PALLET DETECTED RIGHT SIDE EXLOCK SEN54
I:053
16
PAUSE PALLET EXITLOCK MOTOR 20 PAUSE M20PXL
B3
490
[628]
0:063/03 - -|/|- - File #2 MAIN_PRGRM - 334
T4:260.TT - -| |- - File #2 MAIN_PRGRM - 330
MOTOR 20 SLOW M20S
O:063
03
MOTOR 20 SLOW PULSE M20SP
TON
TIMER ON DELAY
TIMER: T4:260
BASE (SEC): 0.01
PRESET: 100
ACCUM: 0
(EN)
(DN)
MOTOR 20 REVERSE M20R
B3
120
[587]
DOOR 11 OPEN DROP11S
I:056
05
PALLET DETECTED LEFT SIDE EXIT LOCK SEN52
I:053
14
Rung #334
MOTOR 20 SLOW M20S
O:063
03
[333]
MOTOR 20 SLOW STOP PULSE M20SSP
TON
TIMER ON DELAY
TIMER: T4:280
BASE (SEC): 0.01
PRESET: 100
ACCUM: 101
(EN)
(DN)
T4:280.TT - -| |- - File #2 MAIN_PRGRM - 330

Rung #335

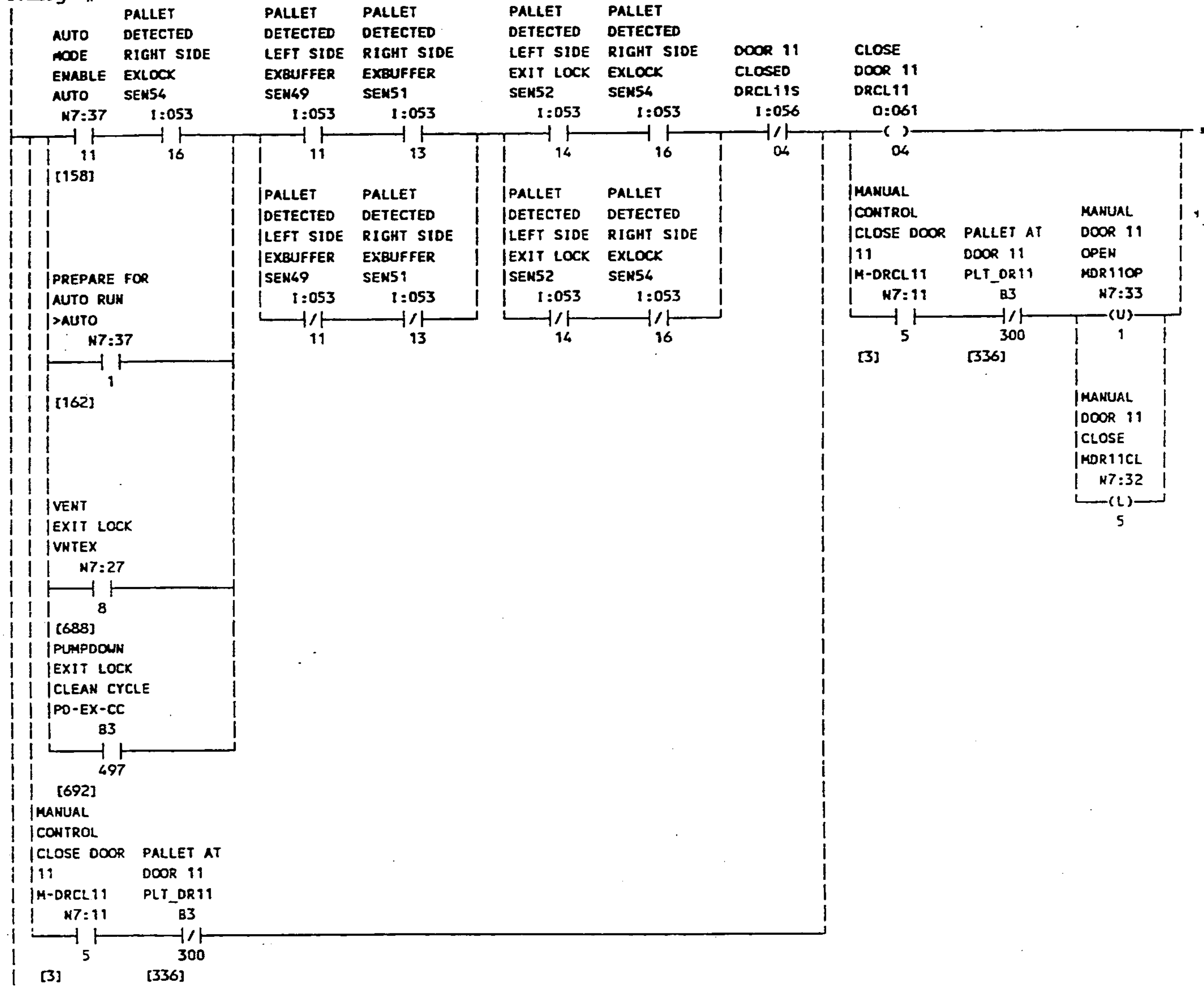



```
O:061/02 - -| |- - File #5 FAULTS -  35
                   File #6 TECH_RUNGS -  3
           -( )- - File #2 MAIN_PRGRM -  335
N7:33/0 - -(L)- - File #2 MAIN_PRGRM -  326
          -(U)- - File #2 MAIN_PRGRM -  335
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/4 - -(L)- - File #2 MAIN_PRGRM -  335
          -(U)- - File #2 MAIN_PRGRM -  326
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #336

```
|                  PALLET       PALLET
| PALLET IN        DETECTED     DETECTED
| CENTER           RIGHT SIDE   LEFT SIDE                                   PALLET AT |
| EXBUFFER         EXBUFFER     EXIT LOCK                                   DOOR 11   |
| SEN50            SEN51        SEN52                                       PLT_DR11  |
|    I:053           I:053        I:053                                        B3     |
|-+----] [-----+-----] [---------] [--------------------------------------------( )---|
| |     12     |     13           14                                           300    |
| |PALLET      | B3/300 - -|/|- - File #2 MAIN_PRGRM - 337                            |
| |DETECTED    |                                                                      |
| |CENTER      |                                                                      |
| |EXIT LOCK   |                                                                      |
| |SEN53       |                                                                      |
| |   I:053    |                                                                      |
| +----] [-----+                                                                      |
|       15                                                                            |
```

Rung #337




```
O:061/04 - -| |- - File #5 FAULTS -  37
                   File #6 TECH_RUNGS -  3
           -( )- - File #2 MAIN_PRGRM -  337
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #338

```
|                                                                    EXIT LOCK |
|                                                                    AUTO      |
| AUTOPULSE                                                          EXLK_AUTO |
|  T4:282                                                              B3      |
|-+---] [---+-----------------------------------------------------------(L)----|
| |    TT   |                                                          345     |
| |[158]    |                                                                  |
| |         | B3/345 - ] [ - File #2 MAIN_PRGRM - 340, 353                     |
| |         |        -(U)- - File #2 MAIN_PRGRM - 339                          |
| |         COMPUTER|                                                          |
| |AUTO     SIGNAL FOR                                                         |
| |MODE     AUTO MODE                                                          |
| |ENABLE   OK      |                                                          |
| |AUTO     COMPAUTO|                                                          |
| | N7:37     N7:16 |                                                          |
| +---] [-----] [---+                                                          |
|     11        11                                                             |
|  [158]   [3]                                                                 |
```

Rung #339

```
| VENT-PUMP                                                                    |
| CYCLE EXIT                                                         EXIT LOCK |
| LOCK                                                               AUTO      |
| VNT-PD-EX                                                          EXLK_AUTO |
|    N7:27                                                             B3      |
|-+---] [---+-----------------------------------------------------------(U)----|
| |    9    |                                                          345     |
| |[690]    |                                                                  |
| |         | B3/345 - ] [ - File #2 MAIN_PRGRM - 340, 353                     |
| |         |        -(L)- - File #2 MAIN_PRGRM - 338                          |
| |VENT     |                                                                  |
| |EXIT LOCK|                                                                  |
| |VNTEX    |                                                                  |
| |  N7:27  |                                                                  |
| +---] [---+                                                                  |
| |    8    |                                                                  |
| |[688]    |                                                                  |
| |AUTO MODE|                                                                  |
| |DISABLE  |                                                                  |
| |TS10     |                                                                  |
| |  N7:16  |                                                                  |
| +---] [---+                                                                  |
|      2                                                                       |
|  [3]                                                                         |
```

Rung #340

```
OPEN ROUGHING VALVES 1->5  OP_RV1->5   B3 309  [104]
EXITLOCK CHAMBER <250 MICRONS PIR17   I:054 -|/|- 10
BLOWER 3 ENABLED BL3                  O:057 -| |- 01  [100]
OPEN EXLOCK CHAMBER VENT VALVE CVS    O:057 -|/|- 16  [346]
DOOR 12 CLOSED DRCL12S                I:056 -| |- 06
MECHANICAL PUMP 3 ISOLATION VALVE OPEN MP3IVOP  I:055 -| |- 14
OPEN EXLOCK ROUGH VALVE RVS           O:060 -( )- 12

Branch:
EXIT LOCK AUTO EXLK_AUTO              B3 345 -| |-   [339]
DOOR 11 CLOSED DRCL11S                I:056 04 -| |-
DOOR 12 CLOSED DRCL12S                I:056 06 -| |-
PALLET DETECTED RIGHT SIDE EXLOCK SENS4  I:053 16 -|/|-

Branch:
PUMPDOWN EXIT LOCK CLEAN CYCLE PD-EX-CC  B3 497 -| |-  [692]

Branch:
PUMP DOWN EXIT LOCK PDEX              N7:27 10 -| |-  [698]

Branch:
PUMP AREA 5 ENABLE PUMP5E             N7:38 1 -| |-   [451]
OPEN ROUGH VALVE 5 DELAY T5RVTMR      T4:4 DN -| |-   [456]
EXIT BUFFER CHAMBER =<250 MICRONS PIR15  I:040 13 -|/|-

Branch:
MANUAL ROUGH PUMP VALVE 5 OPEN MRVP5OP  N7:28 4 -| |-  [507]
```

```
O:060/12 - -| |- - File #2 MAIN_PRGRM -  341
                   File #5 FAULTS -  175
                   File #6 TECH_RUNGS -  0
           -|/|- - File #5 FAULTS -  177
           -( )- - File #2 MAIN_PRGRM -  340
```

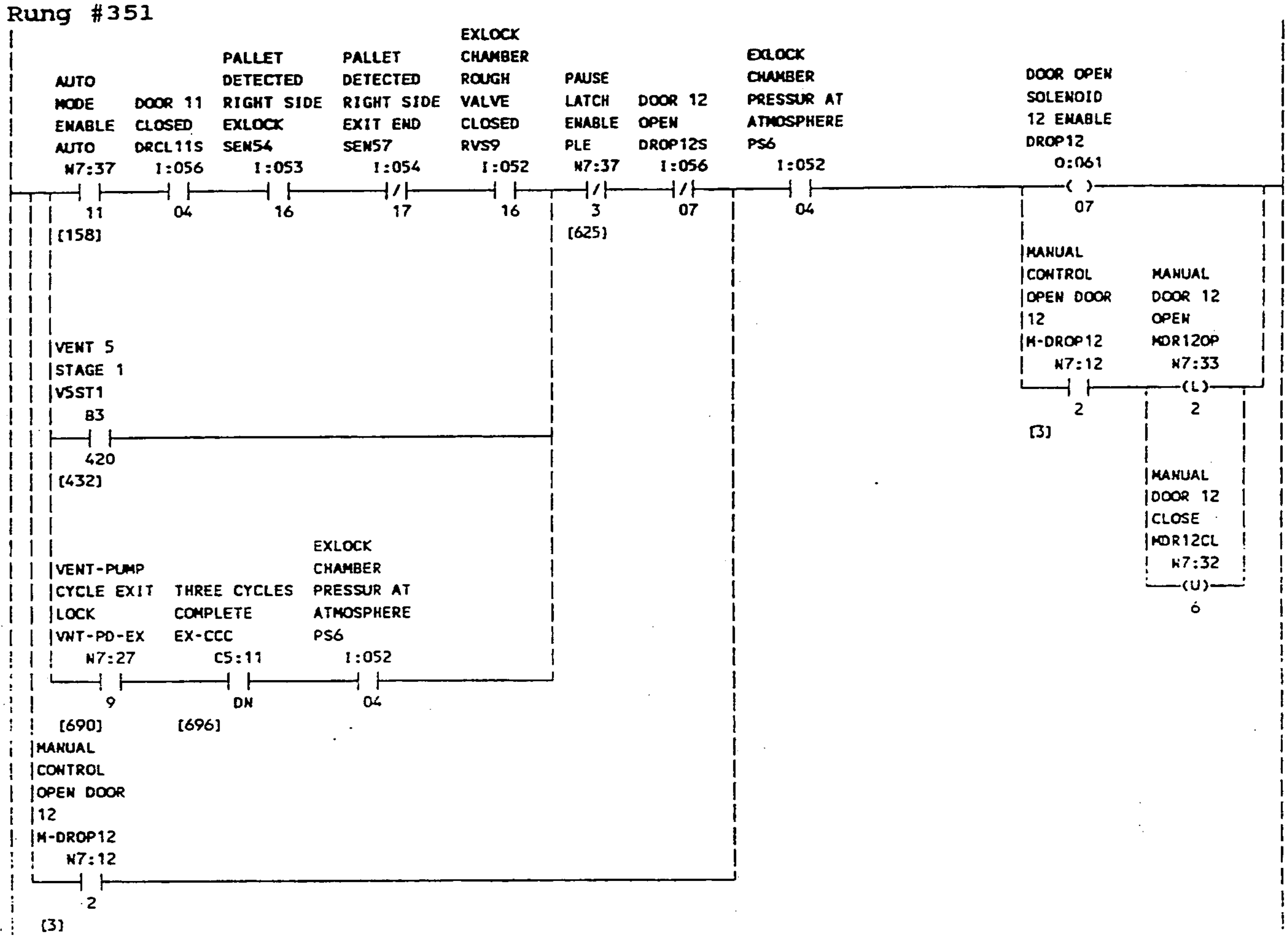
```
Rung #341
|        OPEN
|AUTO    EXLOCK                                              EXIT LOCK
|MODE    ROUGH                                               ROUGHING
|ENABLE  VALVE                                               TIMER
|AUTO    RV5                                                 EXRUFFTMR
| N7:37  0:060                                               +-TON-----------------+
|--| |----| |------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  11      12                                                |TIMER:       T4:166|
|[158]   [340]                                               |BASE (SEC):    1.0 +-(DN)
|                                                            |PRESET:         60|
|                                                            |ACCUM:           0|
|                                                            +-------------------+
T4:166.DN - -| |- - File #2 MAIN_PRGRM -  342
Rung #342
|                                                                      EXIT LOCK
|                                                                      ROUGHING
|                                                                      >60 SEC
|EXRUFFTMR                                                             EXLKRUFF>60S
|  T4:166                                                                   B3
|---| |------------------------------------------------------------------(L)---
|     DN                                                                   817
|[341]
B3/817 - -| |- - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  342
        -(U)- - File #2 MAIN_PRGRM -  343
Rung #343
|
|PAUSE                                                                 EXIT LOCK
|DISABLE                                                               ROUGHING
|TS12                                                                  >60 SEC
|  N7:16                                                               EXLKRUFF>60S
|---| |------------------------------------------------------------------(U)---
|    4                                                                     817
|[3]
B3/817 - -| |- - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  342
        -(U)- - File #2 MAIN_PRGRM -  343
Rung #344
|
|VENT 5                                                      VENT 5 STAGE1
|STAGE 1                                                     VENT 5 DELAY
|V5ST1                                                       TIMER
|  B3                                                        V5CV5DYTMR
|---| |------------------------------------------------------+-TON-----------------+
|  420                                                       |TIMER ON DELAY      +-(EN)-
|[432]                                                       |TIMER:        T4:30|
|                                                            |BASE (SEC):    1.0 +-(DN)
|                                                            |PRESET:          5|
|                                                            |ACCUM:           0|
|                                                            +-------------------+
T4:30.DN - -| |- - File #2 MAIN_PRGRM -  346
Rung #345
|
|                                                            VENT OPEN
|DOOR 11                                                     DELAY ON
|CLOSED                                                      DOOR 11
|DRCL11S                                                     CLOSE
|  I:056                                                     VDOR11CL
|---| |------------------------------------------------------+-TON-----------------+
|   04                                                       |TIMER ON DELAY      +-(EN)-
|                                                            |TIMER:       T4:202|
| T4:202.DN - -| |- - File #2 MAIN_PRGRM - 346               |BASE (SEC):    1.0 +-(DN)
|                                                            |PRESET:          1|
|                                                            |ACCUM:           1|
>                                                            >>>>>>>>>>>>>>>>>>     >
```

```
Rung #346

                                         EXLOCK
                                         CHAMBER  PALLET                                                  OPEN
   AUTO                                  ROUGH    DETECTED                                                EXLOCK
   MODE     DOOR 11  DOOR 12             VALVE    RIGHT SIDE                                              CHAMBER
   ENABLE   CLOSED   CLOSED              CLOSED   EXLOCK                                                  VENT VALVE
   AUTO     DRCL11S  DRCL12S             RVS9     SEN54            VDOR11CL                               CVS
   N7:37    I:056    I:056               I:052    I:053            T4:202                                 0:057
|--] [------] [------] [------] [--------] [--------+---] [---+---------------------------------(L)---
    11       04       06                  16        16     |    DN    |                                     16
   [158]                                                    [345]
                                                                       0:057/16 - ] [ - File #2 MAIN_PRGRM - 347
                                                                                        File #6 TECH_RUNGS - 0
                                                            EXITLOCK                 ]/[ - File #2 MAIN_PRGRM - 67, 327, 340,
                                                            CHAMBER                     368, 453, 689, 695
   CHAMBER VENT 5                                           GATE VALVE              -(U)- - File #2 MAIN_PRGRM - 367
   DELAY TIMER                                              CLOSED
   VSCVSDYTMR                                               HV12S1
      T4:30                                                  I:054
  |---] [------------------------------------------|      |---] [---|
       DN                                                      03
   [344]
            EXLOCK
            CHAMBER
            ROUGH
   READY TO VALVE
   VENT     CLOSED
   RTVCVDT  RVS9
    T4:0     I:052
  |--] [------] [----------------------------------|
     DN       16
   [392]
   MANUAL CONTROL
   CHAMBER VENT 5
   OPEN
   M-CV5-1
        N7:6
  |-----] [----------------------------------------|
        15
   [3]
                                          EXLOCK
                                          CHAMBER
  VENT      DOOR 11   DOOR 12             PRESSUR AT
  EXIT LOCK CLOSED    CLOSED              ATMOSPHERE
  VNTEX     DRCL11S   DRCL12S             PS6
   N7:27     I:056     I:056               I:052
|---] [-------] [-------] [-------]/[----------------------|
     8         04        06         04
  [688]
            EXLOCK
            CHAMBER
  VENT      PRESSUR AT
  EXIT LOCK ATMOSPHERE
  VNT-EX    PS6
    B3       I:052
|---] [-------]/[------------------------------------------|
    498        04
  [694]
```

```
Rung #347
|        OPEN
|AUTO    EXLOCK
|MODE    CHAMBER     PAUSE                                          EXIT LOCK
|ENABLE  VENT VALVE  DISABLE                                        VENT TIMER
|AUTO    CVS         TS12                                           EXVNTTIMER
| N7:37    O:057      N7:16                                         +--TON-----------------+
|--] [------] [--------]/[------------------------------------------|TIMER ON DELAY        |-(EN)-
|   11       16         4                                           |TIMER:          T4:99 |
|[158]   [346]        [3]                                           |BASE (SEC):       1.0 |-(DN)
|                                                                   |PRESET:           100 |
|                                                                   |ACCUM:              0 |
|                                                                   +----------------------+
T4:99.DN - - ] [ - File #2 MAIN_PRGRM -  348
Rung #348
|                                                                       EXIT LOCK
|                                                                       VENT>30 SECS
|EXVNTTIMER                                                             EXLKVNT>30SECS
|  T4:99                                                                  B3
|--] [---------------------------------------------------------------------(L)----
|    DN                                                                   815
|[347]
B3/815 - ] [ - - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  348
        -(U)- - File #2 MAIN_PRGRM -  349
Rung #349
|PAUSE                                                                  EXIT LOCK
|DISABLE                                                                VENT>30 SECS
|TS12                                                                   EXLKVNT>30SECS
| N7:16                                                                   B3
|--] [---------------------------------------------------------------------(U)----
|   4                                                                     815
|[3]
B3/815 - ] [ - - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  348
        -(U)- - File #2 MAIN_PRGRM -  349
Rung #350
|                                                                       EXITLOCK
|DOOR 12                                                                AIR SWEEP
|OPEN                                                                   SOLENOID
|DROP12S                                                                EXSWEEP
| I:056                                                                   O:061
|--] [---------------------------------------------------------------------( )----
|   07                                                                     10
```

Rung #351

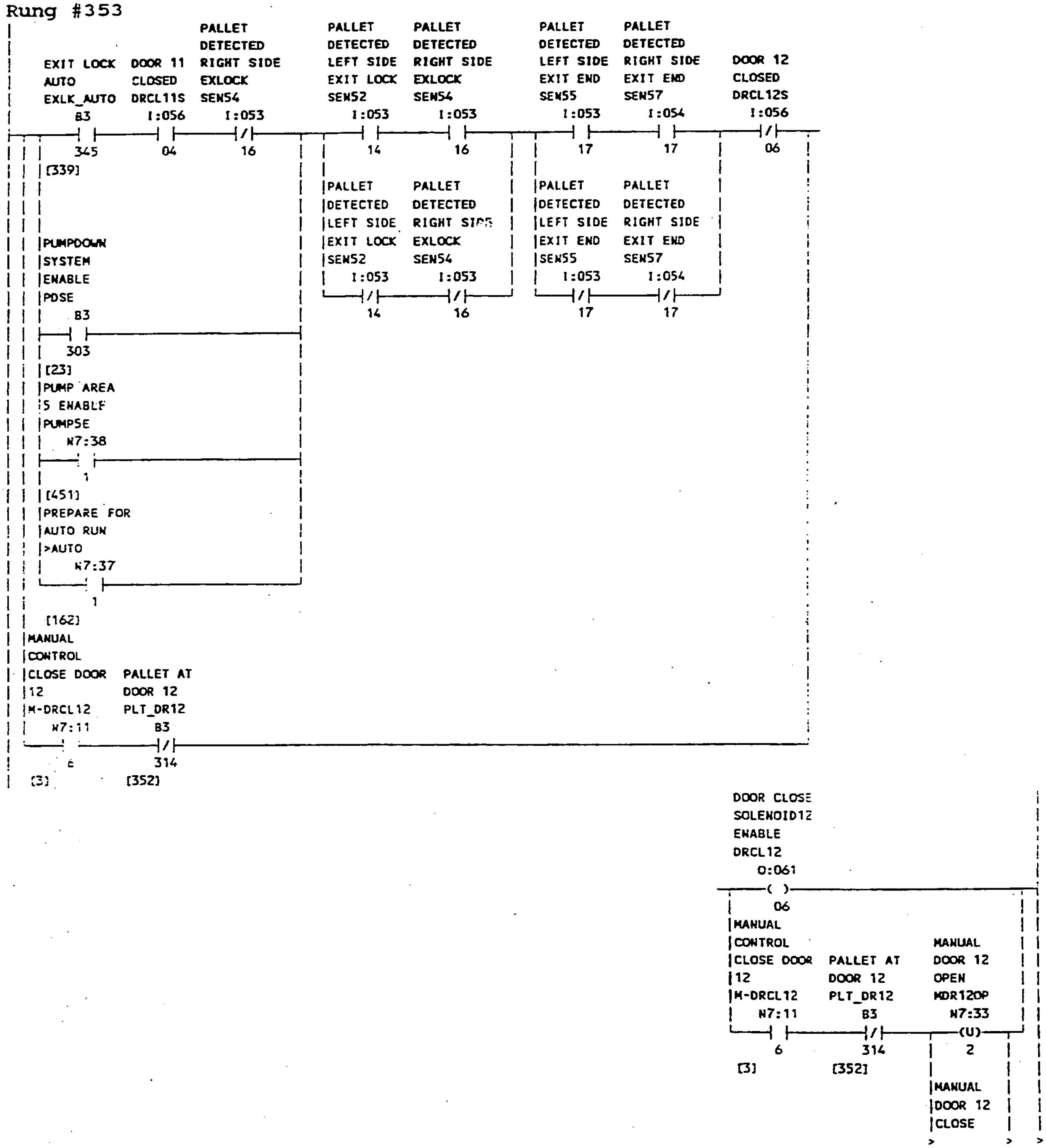



```
O:061/07 - -| |- - File #5 FAULTS -  63
         -( )- - File #2 MAIN_PRGRM -  351
N7:33/2 - -(L)- - File #2 MAIN_PRGRM -  351
         -(U)- - File #2 MAIN_PRGRM -  353
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/6 - -(L)- - File #2 MAIN_PRGRM -  353
         -(U)- - File #2 MAIN_PRGRM -  351
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #352

```
| PALLET       PALLET      PALLET                                                                                        |
| DETECTED     DETECTED    DETECTED                                                                                      |
| CENTER       RIGHT SIDE  LEFT SIDE                                                                          PALLET AT  |
| EXIT LOCK    EXLOCK      EXIT END                                                                           DOOR 12    |
| SEN53        SEN54       SEN55                                                                              PLT_DR12   |
|    I:053        I:053       I:053                                                                             B3      |
|--+---] [---+----] [---------] [--------------------------------------------------------------------------( )--------|
|  |   15    |      16          17                                                                          314      |
|  |PALLET   | B3/314 - ]/[ - File #2 MAIN_PRGRM - 353                                                                |
|  |DETECTED |                                                                                                       |
|  |CENTER   |                                                                                                       |
|  |EXIT END |                                                                                                       |
|  |SEN56    |                                                                                                       |
|  |  I:054  |                                                                                                       |
|  +---] [---+                                                                                                       |
|      16                                                                                                             |
```

Rung #353


EXIT LOCK AUTO EXLK_AUTO B3 345 [339]
DOOR 11 CLOSED DRCL11S I:056 04
PALLET DETECTED RIGHT SIDE EXLOCK SEN54 I:053 16
PALLET DETECTED LEFT SIDE EXIT LOCK SEN52 I:053 14
PALLET DETECTED RIGHT SIDE EXLOCK SEN54 I:053 16
PALLET DETECTED LEFT SIDE EXIT END SEN55 I:053 17
PALLET DETECTED RIGHT SIDE EXIT END SEN57 I:054 17
DOOR 12 CLOSED DRCL12S I:056 06
PALLET DETECTED LEFT SIDE EXIT LOCK SEN52 I:053 14
PALLET DETECTED RIGHT SIDE EXLOCK SEN54 I:053 16
PALLET DETECTED LEFT SIDE EXIT END SEN55 I:053 17
PALLET DETECTED RIGHT SIDE EXIT END SEN57 I:054 17
PUMPDOWN SYSTEM ENABLE PDSE B3 303 [23]
PUMP AREA 5 ENABLE PUMP5E N7:38 1 [451]
PREPARE FOR AUTO RUN >AUTO N7:37 1 [162]
MANUAL CONTROL CLOSE DOOR 12 M-DRCL12 N7:11 6 [3]
PALLET AT DOOR 12 PLT_DR12 B3 314 [352]
DOOR CLOSE SOLENOID12 ENABLE DRCL12 O:061 06
MANUAL CONTROL CLOSE DOOR 12 M-DRCL12 N7:11 6 [3]
PALLET AT DOOR 12 PLT_DR12 B3 314 [352]
MANUAL DOOR 12 OPEN MDR12OP N7:33 U 2
MANUAL DOOR 12 CLOSE

```
                                                        MDR12CL
                                                         N7:32
                                                       ---(L)---
                                                           6

0:061/06 - -| |- - File #5 FAULTS -  39
                   File #6 TECH_RUNGS -  3
          -( )- - File #2 MAIN_PRGRM -  353
N7:33/2 - -(L)- - File #2 MAIN_PRGRM -  351
          -(U)- - File #2 MAIN_PRGRM -  353
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/6 - -(L)- - File #2 MAIN_PRGRM -  353
          -(U)- - File #2 MAIN_PRGRM -  351
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #354

```
|              MOTOR DRIVE                                   MOTOR 21   |
|              PULSER                                        INTERRUPT  |
|  M21FP       MDP                                          M21I       |
|  T4:221          B3                                           0:062  |
|---| |------------| |-----------------------------------------( )-----|
| |   TT     |     299                                            04   |
| | [355]    | [14]                                                    |
| |M21FSP    |                                                         |
| | T4:241   |                                                         |
| |---| |----|                                                         |
| |   TT     |                                                         |
| | [356]    |                                                         |
| |M21SP     |                                                         |
| |T4:261    |                                                         |
| |---| |----|                                                         |
| |   TT     |                                                         |
| | [357]    |                                                         |
| |M21SSP    |                                                         |
| | T4:281   |                                                         |
| |---| |----|                                                         |
|     TT                                                               |
|  [358]                                                               |
```

```
Rung #355
|
|                                  PALLET       PALLET       PAUSE
| AUTO                             DETECTED     DETECTED     PALLET AT
| MODE        DOOR 12              RIGHT SIDE   RIGHT SIDE   EXIT        MOTOR 21                              MOTOR 21
| ENABLE      OPEN                 EXLOCK       EXIT END     MOTOR 21    REVERSE                               FAST
| AUTO        DROP12S              SEN54        SEN57        M21PPX      M21R                                  M21F
|  N7:37       I:056                I:053        I:054         B3          B3                                   O:062
|---] [-------] [-------------------] [-----------]/[----------]/[---------]/[----------------------------------( )-----|
| |  11    |   07      |  |  16      |    17     |   410         121                                  |  14        | |
| | [158]  |           |  |          |           |  [628]       [588]                                 |            | |
| |        |PALLET     |  |PALLET    |           |                                                    |            | |
| |        |DETECTED   |  |DETECTED  |           |                                                    |            | |
| |        |RIGHT SIDE |  |LEFT SIDE |           |                                                    |MOTOR 21    | |
| |        |EXLOCK     |  |EXIT END  |           |                                                    |FAST PULSE  | |
| |        |SEN54      |  |SEN55     |           |                                                    |M21FP       | |
| |        |   I:053   |  |   I:053  |           |                                                    | +-TON--------------+ |
| |        +----]/[----+  +----] [---+           |                                                    +-|TIMER ON DELAY   |-(EN)-+
| |             16             17                |                                                      |TIMER:    T4:221 |
| |                                              |                                                      |BASE (SEC):  0.01|-(DN)
| |                                              |                                                      |PRESET:      100 |
| |                                              |                                                      |ACCUM:         0 |
| |MANUAL MOTOR                                  |                                                      +-----------------+
| |21 ON                                         |
| |MM21ON                                        |
| |    N7:24                                     |
| +-----] [--------------------------------------+
| |      3                                       |
| |[531]                                         |
| |                 PALLET                       |
| |ENTER            DETECTED                     |
| |AUTOMATION       RIGHT SIDE                   |
| |SYSTEM           EXIT END                     |
| |INAUTO           SEN57                        |
| |   I:055           I:054                      |
| +----] [-------+-----] [-----+-----------------+
|        02      |      17     |
|                |PALLET       |
|                |DETECTED     |
|                |CENTER       |
|                |EXIT END     |
|                |SEN56        |
|                |   I:054     |
|                +----] [------+
|                      16
O:062/14 - -] [- - File #5 FAULTS -   14
           -]/[- - File #2 MAIN_PRGRM -  356
           -( )- - File #2 MAIN_PRGRM -  355
T4:221.TT - -] [- - File #2 MAIN_PRGRM -  354
Rung #356
|                                                                                              MOTOR 21
|MOTOR 21                                                                                      FAST STOP
|FAST                                                                                          PULSE
|M21F                                                                                          M21FSP
| O:062                                                                                        +-TON---------------+
|---]/[----------------------------------------------------------------------------------------|TIMER ON DELAY     |-(EN)-|
|   14                                                                                         |TIMER:     T4:241  |
|[355]                                                                                         |BASE (SEC):   0.01 |-(DN)
|                                                                                              |PRESET:       100  |
|                                                                                              |ACCUM:        102  |
|                                                                                              +-------------------+
T4:241.TT - -] [- - File #2 MAIN_PRGRM -  354
```

Rung #357

MANUAL MOTOR
21 ON
MM21ON
N7:24
3
[531]

PAUSE
PALLET AT
EXIT
MOTOR 21
M21PPX
B3
410
[628]
0:063/04 - ┤/├ - File #2 MAIN_PRGRM - 358
T4:261.TT - ┤ ├ - File #2 MAIN_PRGRM - 354

MOTOR 21
SLOW
M21S
0:063
( )
04

ENTER
AUTOMATION
SYSTEM
INAUTO
I:055
02

PALLET
DETECTED
RIGHT SIDE
EXIT END
SEN57
I:054
17

PALLET
DETECTED
CENTER
EXIT END
SEN56
I:054
16

MOTOR 21
REVERSE
M21R
B3
121
[588]

DOOR 12
OPEN
DROP12S
I:056
07

PALLET
DETECTED
LEFT SIDE
EXIT END
SEN55
I:053
17

MOTOR 21
SLOW PULSE
M21SP
TON
TIMER ON DELAY (EN)
TIMER: T4:261
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

Rung #358

MOTOR 21
SLOW
M21S
0:063
04
[357]

MOTOR 21
SLOW STOP
PULSE
M21SSP
TON
TIMER ON DELAY (EN)
TIMER: T4:281
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 101

T4:281.TT - ┤ ├ - File #2 MAIN_PRGRM - 354

```
Rung #359
THE PALLET COUNTER
|             PALLET                                                                                    |
|PALLET IN    DETECTED                                                                        PALLET    |
|CENTER       RIGHT SIDE                                                                      COUNTER   |
|EXBUFFER     EXBUFFER                                                                        LATCH     |
|SEN50        SEN51                                                                           PALCNT    |
|   I:053        I:053                                                                          B3      |
|----| |--------|/|---------------------------------------------------------------------------(L)------|
|     12          13                                                                            100     |
B3/100 - -| |- - File #2 MAIN_PRGRM -  361,363,364
         -(L)- - File #2 MAIN_PRGRM -  359
         -(U)- - File #2 MAIN_PRGRM -  360
Rung #360
THE PALLET COUNTER
|PALLET                                                                                                 |
|DETECTED                                                                                     PALLET    |
|RIGHT SIDE                                                                                   COUNTER   |
|EXBUFFER                                                                                     LATCH     |
|SEN51                                                                                        PALCNT    |
|   I:053                                                                                       B3      |
|----| |---------------------------------------------------------------------------------------(U)------|
|     13                                                                                        100     |
B3/100 - -| |- - File #2 MAIN_PRGRM -  361,363,364
         -(L)- - File #2 MAIN_PRGRM -  359
         -(U)- - File #2 MAIN_PRGRM -  360
Rung #361
|PALLET                                                                                                 |
|COUNTER                                                                 PALLET                         |
|LATCH                                                                   COUNTER                        |
|PALCNT                                                                  PCOUNT                         |
|   B3                                                                   +-CTU----------+               |
|----| |-----------------------------------------------------------------|COUNT UP      |-(CU)-|
|   100                                                                  |COUNTER: C5:16|               |
|[360]                                                                   |PRESET:  10000|-(DN) |
|                                                                        |ACCUM:      90|               |
|                                                                        +--------------+               |
C5:16 - CTU - File #2 MAIN_PRGRM -  361
        RES - File #2 MAIN_PRGRM -  362
Rung #362
|INCREMENTAL                                                                                            |
|PALLET COUNTER                                                                               PALLET    |
|RESET                                                                                        COUNTER   |
|INC_CNT-RST                                                                                  PCOUNT    |
|       B3                                                                                     C5:16    |
|--------| |-----------------------------------------------------------------------------------(RES)----|
|       526                                                                                             |
C5:16 - CTU - File #2 MAIN_PRGRM -  361
        RES - File #2 MAIN_PRGRM -  362
Rung #363
|PALLET                                                                 NON-RESETABLE                  |
|COUNTER                                                                PALLET COUNTER                 |
|LATCH                                                                  A                              |
|PALCNT                                                                 NRSTCNTR_A                     |
|   B3                                                                  +-CTU----------+               |
|----| |----------------------------------------------------------------|COUNT UP      |-(CU)-|
|   100                                                                 |COUNTER: C5:17|               |
|[360]                                                                  |PRESET:   1000|-(DN) |
|                                                                       |ACCUM:     889|               |
|                                                                       +--------------+               |
C5:17 - CTU - File #2 MAIN_PRGRM -  363
        RES - File #2 MAIN_PRGRM -  365
```

```
C5:17.DN - -| |- - File #2 MAIN_PRGRM    364,365
Rung #364
|PALLET                                                        NON-RESETABLE        |
|COUNTER                                                       PALLET COUNTER       |
|LATCH                                                         B                    |
|PALCNT   NRSTCNTR_A                                           NRSTCNTR_B           |
|   B3        C5:17                                            +-CTU-----------+    |
|---| |--------| |---------------------------------------------+COUNT UP       +-(CU)-|
|  100          DN                                             |COUNTER:  C5:18|    |
|[360]     [363]                                               |PRESET:    1000+-(DN) |
|                                                              |ACCUM:       53|    |
|                                                              +---------------+    |
Rung #365
|                                                                  NON-RESETABLE    |
|                                                                  PALLET COUNTER   |
|                                                                  A                |
|NRSTCNTR_A                                                        NRSTCNTR_A       |
|   C5:17                                                               C5:17       |
|---| |-------------------------------------------------------------------[RES]------|
|     DN                                                                            |
|[365]                                                                              |
C5:17 - CTU - File #2 MAIN_PRGRM -  363
        RES - File #2 MAIN_PRGRM -  365
C5:17.DN - -| |- - File #2 MAIN_PRGRM -  364
Rung #366
|EXLOCK                                                                             |
|CHAMBER                                                                            |
|PRESSUR AT                                                    CHAMBER VENT 5       |
|ATMOSPHERE                                                    CLOSE DELAY          |
|PS6                                                           CVS_DLY              |
|   I:052                                                      +-TON-------------+  |
|---| |--------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|    04                                                        |TIMER:    T4:329|  |
|                                                              |BASE (SEC):  1.0+-(DN) |
| T4:329.DN - -| |- - File #2 MAIN_PRGRM - 367                  |PRESET:        1|  |
|                                                              |ACCUM:         0|  |
|                                                              +----------------+  |
```

```
Rung #367
                                                                                    OPEN
                                                                                    EXLOCK
                                                                                    CHAMBER
                                                                                    VENT VALVE
 CVS_DLY                                                                            CVS
  T4:329                                                                              O:057
|--] [--+---------------------------------------------------------------------------(U)---|
|  DN   |                                                                              16
|[366]  |  O:057/16 - ] [ - File #2 MAIN_PRGRM - 347
|       |                 File #6 TECH_RUNGS - 0
|MANUAL |            ]/[ - File #2 MAIN_PRGRM - 67, 327, 340, 368, 453, 689, 695
|CONTROL|            (L) - File #2 MAIN_PRGRM - 346
|CHAMBER
|VENT VALVE
|5 CLOSE
|M-CVS-O
|  N7:4
|--] [----------------------+
|   4
|[3]
|           EXITLOCK
|           CHAMBER
|DOOR 11    GATE VALVE
|CLOSED     CLOSED
|DRCL11S    HV12S1
|  I:056     I:054
|--]/[-------]/[------------+
|   04        03
|                      BUFFER 4
|                      CHAMBER
|DOOR 11    DOOR 10    GATE VALVE
|OPEN       OPEN       CLOSED
|DROP11S    DROP10S    HV11S1
|  I:056     I:056       I:054
|--] [-------] [------+---]/[---+---+
|   05        03      |    00   |
|                     |DWELL 6  |
|                     |CHAMBER  |
|                     |GATE VALVE
|                     |CLOSED   |
|                     |HV10S1   |
|                     |  I:052  |
|                     +---]/[---+
|                     |    06   |
|                     |DWELL 5  |
|                     |CHAMBER  |
|                     |GATE VALVE
|                     |CLOSED   |
|                     |HV9S1    |
|                     |  I:040  |
|                     +---]/[---+
|                          03
|                         EXLOCK
|PUMPDOWN                 CHAMBER
|EXIT LOCK    DOOR 11     PRESSUR AT
|CLEAN CYCLE  CLOSED      ATMOSPHERE
|PD-EX-CC     DRCL11S     PS6
|   B3          I:056       I:052
|---] [---------] [---------] [-----+
|   497           04          04
|[692]
|          EXLOCK
> >                                 >                                                      >
```

```
< <
| |            CHAMBER
| |VENT        PRESSUR AT
| |EXIT LOCK   ATMOSPHERE
| |VNT-EX      PS6
| |   B3        I:052
| |---] [------] [--------|
| |   498       04
| |[694]
| |ABORT SYSTEM
| |VENT
| |BORT_SYS_VNT
| |   N7:17
| |---] [----------------|
|     10
| [3]
Rung #368
| ALL         OPEN                                            OPEN
| CHAMBERS    LOAD LOCK   OPEN        OPEN        OPEN        EXLOCK                          SYSTEM
| AT          CHAMBER     DWELL 2     DWELL 3     DWELL 5     CHAMBER                         VENT
| ATMOSPHERE  VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE                      ENABLE
| CH@ATMOS    CV1         CV2         CV3         CV4         CV5                             SYSVNTE
|    B3       O:007       O:007       O:027       O:043       O:057                            N7:37
|---] [--------]/[---------]/[---------]/[---------]/[---------]/[--------------------------------(U)--
| |  383       16          17          16          16          16                                5
| |[404]      [177]       [396]       [401]       [403]       [367]
| |                                                                 | N7:37/5 - ] [ - - File #2 MAIN_PRGRM - 34, 35, 36,
| |                                                                 |   37, 43, 46, 47, 48, 49, 110,
| |                                                                 |   111, 112, 113, 114, 200, 216,
| |                                                                 |   324, 326, 327, 370, 391
| |ABORT SYSTEM                                                     |   ]/[ - File #2 MAIN_PRGRM - 23, 115,
| |VENT                                                             |   117, 118, 119, 120, 121, 122,
| |BORT_SYS_VNT                                                     |   123, 124, 125, 126, 127, 128,
| |   N7:17                                                         |   129, 130, 131, 132, 133, 134,
| |---] [-----------------------------------------------------------|   135, 136, 137, 138, 375, 376,
| |   10                                                            |   377, 378, 434, 438, 442, 447,
| |[3]                                                              |   451
| |                                                                 |   -(L)- - File #2 MAIN_PRGRM - 369
| |                                                                 | _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR
| |AUTO RUN
| |>AUTO
| |   N7:37
| |---] [-----------------------------------------------------------|
|     1
| [162]
Rung #369
|          PUMPDOWN                                                          AUTO
|SYSTEM    SYSTEM     PUMP AREA   PUMP AREA   PUMP AREA   PUMP AREA   PUMP AREA   MODE          SYSTEM
|VENT      ENABLE     1 ENABLE    2 ENABLE    3 ENABLE    4 ENABLE    5 ENABLE    ENABLE        VENT
|TS13      POSE       PUMP1E      PUMP2E      PUMP3E      PUMP4E      PUMP5E      AUTO          ENABLE
| N7:16     B3         N7:37       N7:37       N7:37       N7:38       N7:38      N7:37         SYSVNTE
|---] [-----]/[---------]/[---------]/[---------]/[---------]/[---------]/[--------]/[------------N7:37
|   5      303         13          14          15          0           1          11       ---(L)---
|[3]      [23]        [434]       [438]       [442]       [447]       [451]      [158]           5
N7:37/5 - ] [ - - File #2 MAIN_PRGRM -  34,35,36,37,43,46,47,48,49,110,111,112,113,114,200,216,324,326,327,370,391
          ]/[ - - File #2 MAIN_PRGRM -  23,115,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137
                                        138,375,376,377,378,434,438,442,447,451
          -(L)- - File #2 MAIN_PRGRM -  369
          -(U)- - File #2 MAIN_PRGRM -  368
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #370
|                                                                        SYSTEM
|SYSTEM                                                                  VENT
|VENT                                                                    ENABLE
|ENABLE                                                                  PULSE
|SYSVNTE                                                                 SYSVNTPLSE
|  N7:37                                                                 +-TON----------------+
|--] [-------------------------------------------------------------------|TIMER ON DELAY      |-(EN)-
|   5                                                                    |TIMER:      T4:286  |
|[369]                                                                   |BASE (SEC):    1.0  |-(DN)
|                                                                        |PRESET:        180  |
|                                                                        |ACCUM:           0  |
|                                                                        +--------------------+
T4:286 - TON - File #2 MAIN_PRGRM -  370
       LEQ - File #2 MAIN_PRGRM -  84,91,98
T4:286.DN - -] [- - File #2 MAIN_PRGRM -  608

Rung #371
|MANUAL      HEATER 1
|CONTROL     CHAMBER                                                          OPEN RGA
|RGA VALVE   =<250                                                            ISOLATION
|1 OPEN      MICRONS                                                          VALVE 1
|M-RGAV1-1   PIR2                                                             RGAV1
|  N7:7      I:004                                                              O:010
|--] [-------] [------------------------------------------------------------+-----(L)-----
|   5         10                                                            |      13
|[3]                                                                        |
| O:010/13 - -] [- - File #6 TECH_RUNGS - 7                                 |MANUAL RGA
|            -(U)- - File #2 MAIN_PRGRM - 34                                |VALVE 1
| N7:28/5 - -(U)- - File #2 MAIN_PRGRM - 34                                 |OPEN
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                               |MRGAV1OP
| N7:30/1 - -(L)- - File #2 MAIN_PRGRM - 34                                 |  N7:28
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                               +-----(L)-----
|                                                                           |      5
|                                                                           |MANUAL RGA
|                                                                           |VALVE 1
|                                                                           |CLOSE
|                                                                           |MRGAV1CL
|                                                                           |  N7:30
|                                                                           +-----(U)-----
|                                                                                  1

Rung #372
|MANUAL      CHROME
|CONTROL     CHAMBER                                                        OPEN RGA
|RGA VALVE   =<250                                                          ISOLATION
|2 OPEN      MICRONS                                                        VALVE 2
|M-RGAV2-1   PIR6                                                           RGAV2
|  N7:7      I:024                                                            O:030
|--] [-------] [----------------------------------------------------------+-----(L)-----
|   6         07                                                          |      13
|[3]                                                                      |
| O:030/13 - -] [- - File #6 TECH_RUNGS - 7                               |MANUAL RGA
|            -(U)- - File #2 MAIN_PRGRM - 35                              |VALVE 2
| N7:28/6 - -(U)- - File #2 MAIN_PRGRM - 35                               |OPEN
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                             |MRGAV2OP
| N7:30/2 - -(L)- - File #2 MAIN_PRGRM - 35                               |  N7:28
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                             +-----(L)-----
|                                                                         |      6
|                                                                         |MANUAL RGA
|                                                                         |VALVE 2 CLOSE
|                                                                         |MRGAV2CL
|                                                                         |  N7:30
|                                                                         +-----(U)-----
|                                                                                2
```

Rung #373

```
|MANUAL      MAGNETIC                                                          |
|CONTROL     CHAMBER                                              OPEN RGA     |
|RGA VALVE   =<250                                                ISOLATION    |
|3 OPEN      MICRONS                                              VALVE 3      |
|M-RGAV3-1   PIR11                                                RGAV3        |
|  N7:7      I:040                                                  0:044      |
|---] [------] [----------------------------------------------------+--(L)---+-|
|    7        07                                                  |   13     | |
|[3]                                                              |          | |
| 0:044/13 - ] [ - File #6 TECH_RUNGS - 7                         |MANUAL RGA| |
|            -(U)- - File #2 MAIN_PRGRM - 36                      |VALVE 3   | |
| N7:28/7 - -(U)- - File #2 MAIN_PRGRM - 36                       |OPEN      | |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                     |MRGAV3OP  | |
| N7:30/3 - -(L)- - File #2 MAIN_PRGRM - 36                       |  N7:28   | |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                     +---(L)----+ |
|                                                                 |   7      | |
|                                                                 |MANUAL RGA| |
|                                                                 |VALVE 3 CLOSE |
|                                                                 |MRGAV3CL  | |
|                                                                 |   N7:30  | |
|                                                                 +---(U)----+ |
|                                                                      3        |
```

Rung #374

```
|MANUAL      EXIT BUFFER                                                       |
|CONTROL     CHAMBER                                              OPEN RGA     |
|RGA VALVE   =<250                                                ISOLATION    |
|4 OPEN      MICRONS                                              VALVE 4      |
|M-RGAV4-1   PIR15                                                RGAV4        |
|  N7:7      I:040                                                  0:060      |
|---] [------] [----------------------------------------------------+--(L)---+-|
|    8        13                                                  |   13     | |
|[3]                                                              |          | |
| 0:060/13 - ] [ - File #6 TECH_RUNGS - 7                         |MANUAL RGA| |
|            -(U)- - File #2 MAIN_PRGRM - 37                      |VALVE 4   | |
| N7:28/8 - -(U)- - File #2 MAIN_PRGRM - 37                       |OPEN      | |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                     |MRGAV4OP  | |
| N7:30/4 - -(L)- - File #2 MAIN_PRGRM - 37                       |  N7:28   | |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                     +---(L)----+ |
|                                                                 |   8      | |
|                                                                 |MANUAL RGA| |
|                                                                 |VALVE 4 CLOSE |
|                                                                 |MRGAV4CL  | |
|                                                                 |   N7:30  | |
|                                                                 +---(U)----+ |
|                                                                      4        |
```

Rung #375

```
|                                                                 OPEN         |
|HEATER 1                                                         CAPACITANC   |
|CHAMBER                  SYSTEM                                  MANOMETER    |
|=<250        VENT AREA   VENT                                    ISOLATION    |
|MICRONS      1 ENABLE    ENABLE                                  VALVE 1      |
|PIR2         VENT1E      SYSVNTE                                 CMV1         |
| I:004        N7:37       N7:37                                     0:010     |
|---] [---------]/[---------]/[-------------------------------------------( )---|
|   10           6           5                                         06      |
|              [405]       [369]                                                |
0:010/06 - ] [ - File #6 TECH_RUNGS -  7
           ]/[ - File #2 MAIN_PRGRM -  389,409
           -( )- - File #2 MAIN_PRGRM -  375
```

```
Rung #376
|                                                                    OPEN         |
|CHROME                                                              CAPACITANC   |
|CHAMBER                  SYSTEM                                     MANOMETER    |
|=<250    VENT AREA       VENT                                       ISOLATION    |
|MICRONS  2 ENABLE        ENABLE                                     VALVE 2      |
|PIR6     VENT2E          SYSVNTE                                    CMV2         |
|  I:024     N7:37        N7:37                                        O:030      |
|----] [--------]/[--------]/[--------------------------------------------( )-----|
|   07          7           5                                            06       |
|        [411]       [369]                                                        |
O:030/06 - ] [ - - File #6 TECH_RUNGS -  7
           ]/[ - - File #2 MAIN_PRGRM -  389,416
           ( ) - - File #2 MAIN_PRGRM -  376
Rung #377
|                                                                    OPEN         |
|MAGNETIC                                                            CAPACITANC   |
|CHAMBER                  SYSTEM                                     MANOMETER    |
|=<250    VENT AREA       VENT                                       ISOLATION    |
|MICRONS  3 ENABLE        ENABLE                                     VALVE 3      |
|PIR11    VENT3E          SYSVNTE                                    CMV3         |
|  I:040     N7:37        N7:37                                        O:044      |
|----] [--------]/[--------]/[--------------------------------------------( )-----|
|   07          8           5                                            06       |
|        [418]       [369]                                                        |
O:044/06 - ] [ - - File #6 TECH_RUNGS -  7
           ]/[ - - File #2 MAIN_PRGRM -  389,423
           ( ) - - File #2 MAIN_PRGRM -  377
Rung #378
|                                                                    OPEN         |
|CARBON                                                              CAPACITANC   |
|CHAMBER                  SYSTEM                                     MANOMETER    |
|=<250    VENT AREA       VENT                                       ISOLATION    |
|MICRONS  4 ENABLE        ENABLE                                     VALVE 4      |
|PIR16    VENT4E          SYSVNTE                                    CMV4         |
|  I:054     N7:37        N7:37                                        O:060      |
|----] [--------]/[--------]/[--------------------------------------------( )-----|
|   07          9           5                                            06       |
|        [425]       [369]                                                        |
O:060/06 - ] [ - - File #6 TECH_RUNGS -  7
           ]/[ - - File #2 MAIN_PRGRM -  389,428
           ( ) - - File #2 MAIN_PRGRM -  378
```

BASE : Rung #379

```
| MANUAL                                                                                   |
| CONTROL                                                                        OPEN      |
| GAS FLOW                                                                       GAS FLOW  |
| VALVE 1                                                                        ISOLATION |
| OPEN                                                                           VALVE 1   |
| M-GF1-1                                                                        GF1       |
|   N7:9                                                                           0:010   |
|---] [------------------------------------------------------------------------+---(L)---+-|
| |  15                        |                                              |    07   | |
| |[3]                         |                                              |         | |
| |                            | 0:010/07 - -(U)- - File #2 MAIN_PRGRM - 38   |         | |
| |                            | N7:30/15 - -(U)- - File #2 MAIN_PRGRM - 38   |MANUAL GAS| |
| |                            | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2  |FLOW I V 1| |
| |                            | N7:30/7 - -(L)- - File #2 MAIN_PRGRM - 38    |OPEN     | |
| |HEATER 1       GAS FLOW 1   | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2  |MGFIV1OP | |
| |HIVAC BAFFLE   LATCH ONS    |                                              |  N7:30  | |
| |HV1_2          GF1ONS       |                                              +---(L)---+ |
| |  0:011           B3        |                                              |    15   | |
| +---] [-----------[ONS]------+                                              |         | |
|     12            177                                                       |         | |
| [215]                                                                       |MANUAL GAS| |
|                                                                             |FLOW I V 1| |
|                                                                             |CLOSE    | |
|                                                                             |MGFIV1CL | |
|                                                                             |  N7:30  | |
|                                                                             +---(U)---+ |
|                                                                                  7        |
```

324

12

Rung #380

```
|MANUAL CONTROL                                                                    OPEN
|GAS FLOW VALVE                                                                    GAS FLOW
|2 OPEN                                                                            ISOLATION
|G-GF2-1                                                                           VALVE 2
|     N7:10                                                                        GF2
|                                                                                    O:010
|------| |---------------------------------------------------------------------+---(L)----+
|       0                                                                      |    10    |
|[3]                                                                           |          |
| O:010/10 - -(U)- - File #2 MAIN_PRGRM - 39                                   |MANUAL GAS|
| N7:31/0 - -(U)- - File #2 MAIN_PRGRM - 39                                    |FLOW I V 2|
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                  |OPEN      |
| N7:30/8 - -(L)- - File #2 MAIN_PRGRM - 39                                    |MGFIV2OP  |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                  |   N7:31  |
|                                                                              +---(L)----+
|                                                                              |    0     |
|                                                                              |MANUAL GAS|
|                                                                              |FLOW I V 2|
|                                                                              |CLOSE     |
|                                                                              |MGFIV2CL  |
|                                                                              |   N7:30  |
|                                                                              +---(U)----+
|                                                                                   8
```

BASE : Rung #381

```
MANUAL CONTROL                                                       OPEN
GAS FLOW VALVE                                                       GAS FLOW
3 OPEN                                                               ISOLATION
M-GF3-1                                                              VALVE 3
      N7:10                                                          GF3
                                                                       O:030
---| |----------------------------------------------------------------(L)---
     1                                                                  07
[3]
                  O:030/07 - -| |- - File #2 MAIN_PRGRM - 156
                           -(U)- - File #2 MAIN_PRGRM - 40           MANUAL GAS
                  N7:31/1 - -(U)- - File #2 MAIN_PRGRM - 40          FLOW I V 3
                  _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2        OPEN
 PREPARE FOR  GAS FLOW 3  N7:30/9 - -(L)- - File #2 MAIN_PRGRM - 40  MGFIV3OP
 AUTO RUN     LATCH ONS   _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2  N7:31
 >AUTO        GF3ONS                                                 ---(L)---
    N7:37         63                                                     1
 ---| |-------[ONS]---
     1           178                                                 MANUAL GAS
 [162]                                                               FLOW I V 3
                                                                     CLOSE
                                                                     MGFIV3CL
                                                                        N7:30
                                                                     ---(U)---
                                                                         9
```

Rung #382

```
MANUAL
CONTROL
GAS FLOW                                                             OPEN
VALVE 4                                                              GAS FLOW
OPEN                                                                 ISOLATION
M-GF4-1                                                              VALVE 4
 N7:10                                                               GF4
                                                                       O:030
---| |----------------------------------------------------------------(L)---
    2                                                                   10
[3]
O:030/10 - -(U)- - File #2 MAIN_PRGRM - 41                           MANUAL GAS
N7:31/2 - -(U)- - File #2 MAIN_PRGRM - 41                            FLOW I V 4
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                          OPEN
N7:30/10 - -(L)- - File #2 MAIN_PRGRM - 41                           MGFIV4OP
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                             N7:31
                                                                     ---(L)---
                                                                         2
                                                                     MANUAL GAS
                                                                     FLOW I V 4
                                                                     CLOSE
                                                                     MGFIV4CL
                                                                        N7:30
                                                                     ---(U)---
                                                                        10
```

BASE : Rung #383

```
| MANUAL                                                                 GAS FLOW
| CONTROL                                                                ISOLATION
| GAS FLOW                                                               VALVE 5
| VALVE 5                                                                GFS
| OPEN                                                                    O:044
| M-GF5-1
|  N7:10
|---| |--------------------------------------------------------------------(L)----
     3                                                                     07
|[3]
|        | O:044/07 - -| |- - File #2 MAIN_PRGRM - 156                   |MANUAL GAS
|        |            -(U)- - File #2 MAIN_PRGRM - 42                     |FLOW I V 5
|        | N7:31/3 - -(U)- - File #2 MAIN_PRGRM - 42                      |OPEN
|        | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                    |MGFIV5OP
|PREPARE FOR  GAS FLOW 5 | N7:30/11 - -(L)- - File #2 MAIN_PRGRM - 42     |  N7:31
|AUTO RUN     LATCH ONS  | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2    |---(L)---
|>AUTO        GF5ONS                                                      |    3
|  N7:37        B3
|---| |--------[ONS]---                                                   |MANUAL GAS
     1          179                                                       |FLOW I V 5
 [162]                                                                    |CLOSE
                                                                          |MGFIV5CL
                                                                          |  N7:30
                                                                          |---(U)---
                                                                              11
```

#384

```
|MANUAL
|CONTROL
|GAS FLOW                                                              GAS FLOW
|VALVE 6                                                               ISOLATION
|OPEN                                                                  VALVE 6
|M-GF6-1                                                               GF6
|  N7:10                                                                 O:044
|---| |--------------------------------------------------------------------(L)----
     4                                                                    10
|[3]
| O:044/10 - -(U)- - File #2 MAIN_PRGRM - 43                          |MANUAL GAS
| N7:31/4 - -(U)- - File #2 MAIN_PRGRM - 43                           |FLOW I V 6
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |OPEN
| N7:30/12 - -(L)- - File #2 MAIN_PRGRM - 43                          |MGFIV6OP
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |  N7:31
|                                                                     |---(L)---
|                                                                     |    4
|                                                                     |MANUAL GAS
|                                                                     |FLOW I V 6
|                                                                     |CLOSE
|                                                                     |MGFIV6CL
|                                                                     |  N7:30
|                                                                     |---(U)---
                                                                          12
```

```
BASE :  Rung #385
| MANUAL                                                                                   |
| CONTROL                                                                                  |
| GAS FLOW                                                                     GAS FLOW    |
| VALVE 7                                                                      ISOLATION   |
| OPEN                                                                         VALVE 7     |
| M-GF7-1                                                                      GF7         |
|   N7:10                                                                        O:060     |
|-+---| |----+------------------------------------------------------------+------(L)----+-|
| |     5    |                                                            |       07     | |
| |[3]       |                                                            |              | |
| |          | O:060/07 - -| |- - File #2 MAIN_PRGRM - 156                |              | |
| |          |            -(U)- - File #2 MAIN_PRGRM - 44                 |MANUAL GAS    | |
| |          | N7:31/5 - -(U)- - File #2 MAIN_PRGRM - 44                  |FLOW I V 7    | |
| |          | _F:N7:21%21 - BTW - File #2 MAIN_PRGRM - 2                 |OPEN          | |
| |PREPARE FOR  GAS FLOW 7 | N7:30/13 - -(L)- - File #2 MAIN_PRGRM - 44 |MGFIV7OP      | |
| |AUTO RUN     LATCH ONS  | _F:N7:21%21 - BTW - File #2 MAIN_PRGRM - 2 |  N7:31       | |
| |>AUTO        GF7ONS     |                                            +-----(L)------+ |
| |  N7:37        B3       |                                            |      5       | |
| +----| |--------[ONS]----+                                            |              | |
|        1        180                                                   |              | |
| [162]                                                                 |MANUAL GAS    | |
|                                                                       |FLOW I V 7    | |
|                                                                       |CLOSE         | |
|                                                                       |MGFIV7CL      | |
|                                                                       |  N7:30       | |
|                                                                       +-----(U)------+ |
|                                                                              13         |
```

```
BASE :   Rung #386
| MANUAL                                                                                          |
| CONTROL                                                                                         |
| GAS FLOW                                                                            GAS FLOW    |
| VALVE 8                                                                             ISOLATION   |
| OPEN                                                                                VALVE 8     |
| M-GF8-1                                                                             GF8         |
|   N7:10                                                                               O:060     |
|----] [--------------------------------------------------------------------------+-----(L)----+-|
| |   6                  |                                                        |      10    | |
| |[3]                   |                                                        |            | |
| |                      | O:060/10 - -(U)- - File #2 MAIN_PRGRM - 45             |            | |
| |                      | N7:31/6 - -(U)- - File #2 MAIN_PRGRM - 45              |MANUAL GAS  | |
| |                      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |FLOW I V 8  | |
| |                      | N7:30/14 - -(L)- - File #2 MAIN_PRGRM - 45             |OPEN        | |
| |PREPARE FOR  GAS FLOW 8 | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |MGFIV8OP    | |
| |AUTO RUN     LATCH ONS |                                                       |   N7:31    | |
| |>AUTO        GF8ONS    |                                                       +-----(L)----+ |
| |   N7:37        B3     |                                                       |      6     | |
| +----] [--------[ONS]---+                                                       |            | |
|       1         181                                                              |MANUAL GAS  | |
| [162]                                                                           |FLOW I V 8  | |
|                                                                                 |CLOSE       | |
|                                                                                 |MGFIV8CL    | |
|                                                                                 |   N7:30    | |
|                                                                                 +-----(U)----+ |
|                                                                                        14       |
```

Rung #387

```
|OPEN         OPEN         OPEN         OPEN         OPEN         OPEN                                   CRYO        |
|CRYO ROUGH   CRYO ROUGH   CRYO ROUGH   CRYO ROUGH   CRYO ROUGH   CRYO ROUGH                             VALVES      |
|VALVE 1      VALVE 2      VALVE 3      VALVE 4      VALVE 5      VALVE 6                                1->6        |
|CR1          CR2          CR3          CR4          CR5          CR6                                    CLOSED      |
|                                                                                                        CR1->6_CL   |
|  0:007        0:007        0:007        0:027        0:027        0:027                                  B3        |
|---]/[--------]/[--------]/[--------]/[--------]/[--------]/[-------------------------------------------( )------|
|   11           12           13           11           12           13                                  381       |
|[3:15]       [3:164]      [3:165]      [3:167]      [3:166]      [3:168]                                            |
B3/381 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 387
```

Rung #388

```
|OPEN         OPEN         OPEN         OPEN         OPEN         OPEN                                   CRYO        |
|CRYO ROUGH   CRYO ROUGH   CRYO ROUGH   CRYO ROUGH   CRYO ROUGH   CRYO ROUGH                             VALVES      |
|VALVE 7      VALVE 8      VALVE 9      VALVE 10     VALVE 11     VALVE 12                               7->12       |
|CR7          CR8          CR9          CR10         CR11         CR12                                   CLOSED      |
|                                                                                                        CR7->12_CL  |
|  0:043        0:043        0:043        0:057        0:057        0:057                                  B3        |
|---]/[--------]/[--------]/[--------]/[--------]/[--------]/[-------------------------------------------( )------|
|   11           12           13           11           12           13                                  382       |
|[3:169]      [3:170]      [3:171]      [3:172]      [3:174]      [3:173]                                            |
B3/382 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 388
```

Rung #389

```
|OPEN         OPEN         OPEN         OPEN                                                             ALL CAP.    |
|CAPACITANC   CAPACITANC   CAPACITANC   CAPACITANC                                                       MANOMETER   |
|MANOMETER    MANOMETER    MANOMETER    MANOMETER                                                        ISOLATION   |
|ISOLATION    ISOLATION    ISOLATION    ISOLATION                                                        VALVES      |
|VALVE 1      VALVE 2      VALVE 3      VALVE 4                                                          CLOSED      |
|CMV1         CMV2         CMV3         CMV4                                                             CMIV_CL     |
|  0:010        0:030        0:044        0:060                                                            B3        |
|---]/[--------]/[--------]/[--------]/[-----------------------------------------------------------------( )------|
|   06           06           06           06                                                            380       |
|[375]        [376]        [377]        [378]                                                                        |
B3/380 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 389
```

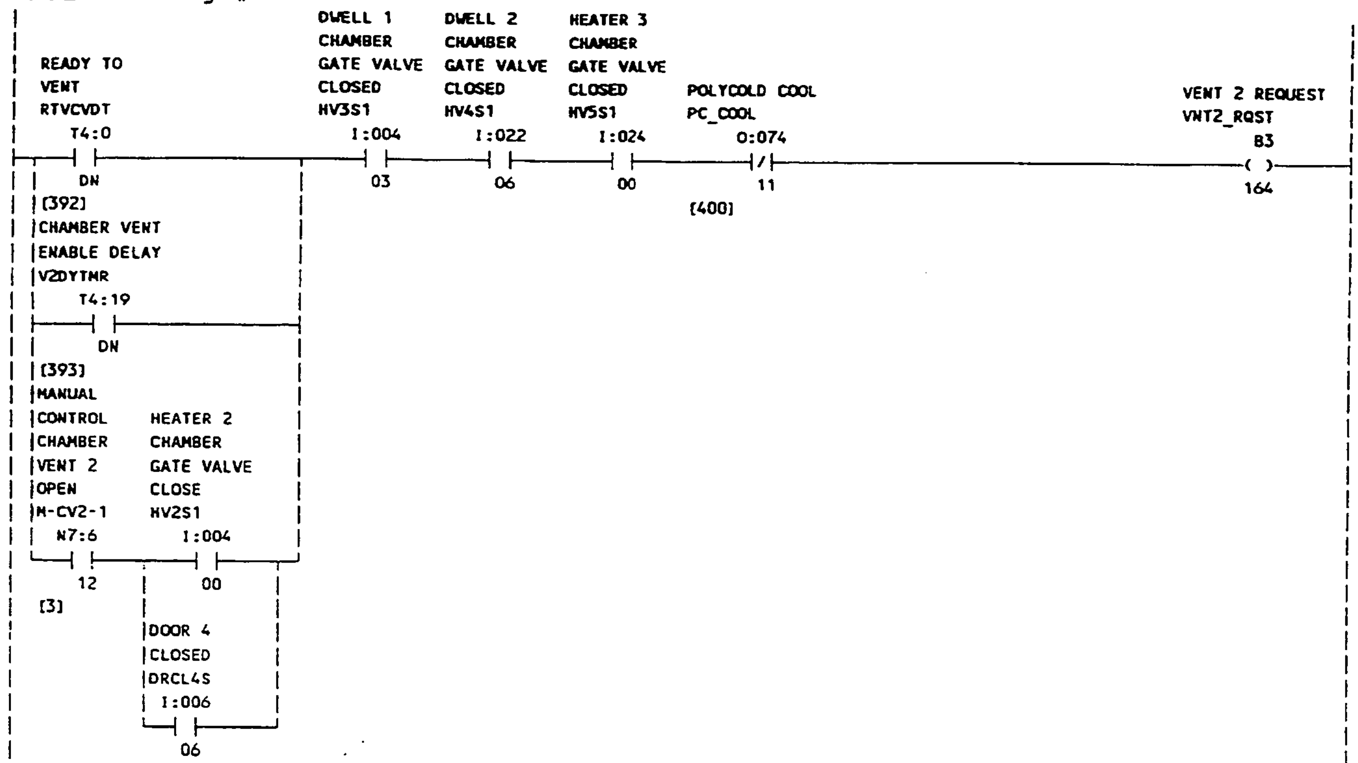
Rung #390

```
|HEATER 1     HEATER 2     DWELL 1      DWELL 2      HEATER 3     DWELL 3      DWELL 4      BUFFER 3     DWELL 5      DWELL 6
|CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER
|GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE
|CLOSE        CLOSE        CLOSED       CLOSED       CLOSED       CLOSED       CLOSED       CLOSED       CLOSED       CLOSED
|HV1S1        HV2S1        HV3S1        HV4S1        HV5S1        HV6S1        HV7S1        HV8S1        HV9S1        HV10S1
|  1:002        1:004        1:004        1:022        1:024        1:024        1:036        1:040        1:040        1:052
|---] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [---
|   06           00           03           06           00           03           06           00           03           06
                                                                                              BUFFER 4     EXITLOCK                 |
                                                                                              CHAMBER      CHAMBER      ALL HIVAC   |
                                                                                              GATE VALVE   GATE VALVE   GATES       |
                                                                                              CLOSED       CLOSED       CLOSED      |
                                                                                              HV11S1       HV12S1       HVGC        |
                                                                                                1:054        1:054        B3        |
                                                                                              ---] [--------] [---------( )---------|
                                                                                                 00           03          150       |

B3/150 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 390
```

```
BASE :  Rung #391
|
|                              ALL CAP.
|                  ALL RGA     MANOMETER   CRYO        CRYO
|SYSTEM   ROUGH    ISOLATION   ISOLATION   VALVES      VALVES       ALL HIVAC
|VENT     VALVES   VALVES      VALVES      1->6        7->12        GATES                 READY TO
|ENABLE   CLOSED   CLOSED      CLOSED      CLOSED      CLOSED       CLOSED                VENT
|SYSVNTE  RVCL     RGACL       CMIV_CL     CR1->6_CL   CR7->12_CL   HVGC                  RTOVENT
| N7:37     B3       B3          B3          B3          B3          B3                     B3
|--] [------] [------] [---------] [---------] [---------] [---------] [----------------------( )--|
|   5       310      305         380         381         382         150                    379
|[369]    [66]     [63]        [389]       [387]       [388]       [390]
B3/379 - ] [ - - File #2 MAIN_PRGRM -  392
       -( )- - File #2 MAIN_PRGRM -  391
       -( )- - File #2 MAIN_PRGRM -  391
Rung #392
|                                                                  READY TO VENT
|READY TO                                                          CHAMBER VENT
|VENT                                                              DELAY TIMER
|RTOVENT                                                           RTVCVDT
|  B3                                                              +-TON-------------+
|--] [-------------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|  379                                                             |TIMER:      T4:0 |
|[391]                                                             |BASE (SEC):  1.0 |-(DN)
|                                                                  |PRESET:        5 |
|                                                                  |ACCUM:         0 |
|                                                                  +-----------------+
T4:0.DN - ] [ - - File #2 MAIN_PRGRM -  173,346,394,401,403
Rung #393
|VENT 2                                                            VENT 2 STAGE1
|STAGE 1                                                           DELAY TIMER
|V2ST1                                                             V2DYTMR
|  B3                                                              +-TON-------------+
|--] [-------------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|  414                                                             |TIMER:     T4:19 |
|[416]                                                             |BASE (SEC):  1.0 |-(DN)
|                                                                  |PRESET:        5 |
|                                                                  |ACCUM:         0 |
|                                                                  +-----------------+
T4:19.DN - ] [ - File #2 MAIN_PRGRM -  394
```

BASE : Rung #394



B3/164 - ┤ ├ - File #2 MAIN_PRGRM - 395,396
-( )- - File #2 MAIN_PRGRM - 394

```
BASE :   Rung #395
|                   POLYCOLD                                                              POLYCOLD |
|VENT 2 REQUEST  SETPOINT HIGH                                                            DEFROST  |
|VNT2_RQST        PCSPH                                                                   PCDEF    |
|   B3               I:002                                                                 O:074   |
|----] [-------------]/[----------------------------------------------------------------------(L)----|
|   164               01                                                                     12    |
|[394]
O:074/12 - ] [ - File #2 MAIN_PRGRM - 399
           ]/[ - File #2 MAIN_PRGRM - 400
          -(L)- - File #2 MAIN_PRGRM - 395
          -(U)- - File #2 MAIN_PRGRM - 398
COMPARE :   Rung #394
|                             DWELL 1      DWELL 2      HEATER 3
|                             CHAMBER      CHAMBER      CHAMBER
|  READY TO                   GATE VALVE   GATE VALVE   GATE VALVE                       POLYCOLD |
|  VENT                       CLOSED       CLOSED       CLOSED                           DEFROST  |
|  RTVCVDT                    HV3S1        HV4S1        HV5S1                            PCDEF    |
|   T4:0                       I:004        I:022        I:024                            O:074   |
|-+--] [-----------------+------] [----------] [----------] [-------------------------------(L)----|
| |   DN                 |       03           06           00                               12    |
| |[392]                 |
| |                      | O:074/12 - ] [ - File #2 MAIN_PRGRM - 399
| |                      |            ]/[ - File #2 MAIN_PRGRM - 400
| |                      |           -(L)- - File #2 MAIN_PRGRM - 395
| |                      |           -(U)- - File #2 MAIN_PRGRM - 398
| |CHAMBER VENT          |
| |ENABLE DELAY          |
| |V2DYTMR               |
| |   T4:19              |
| +----] [---------------+
| |    DN                |
| |[393]                 |
| |MANUAL                |
| |CONTROL   HEATER 2    |
| |CHAMBER   CHAMBER     |
| |VENT 2    GATE VALVE  |
| |OPEN      CLOSE       |
| |M-CV2-1   HV2S1       |
| |  N7:6      I:004     |
| +---] [---+---] [------+
|      12   |    00    |
|  [3]      |          |
|           |DOOR 4    |
|           |CLOSED    |
|           |DRCL4S    |
|           | I:006    |
|           +---] [----+
|                06
```

```
BASE :   Rung #396
|                   POLYCOLD                                                        VENT DELAY        |
|VENT 2 REQUEST     SETPOINT HIGH                                                   TIMER             |
|VNT2_RQST          PCSPH                                                           VNTDLYTMR         |
|     B3            I:002                                                         +--TON----------+   |
|----] [-------------] [----------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|     164           01                                                            |TIMER:   T4:80|    |
|[394)                                                                            |BASE (SEC): 1.0+-(DN)|
|                                                                                 |PRESET:      5|    |
|                                                                                 |ACCUM:       0|    |
|                                                                                 +--------------+    |
T4:80.DN - ] [ - File #2 MAIN_PRGRM -  397
COMPARE :   Rung #395
|POLYCOLD                                                                           VENT DELAY        |
|DEFROST                                                                            TIMER             |
|PCDEF                                                                              VNTDLYTMR         |
|  O:074                                                                          +--TON----------+   |
|----] [--------------------------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|     12                                                                          |TIMER:   T4:80|    |
|[395]                                                                            |BASE (SEC): 1.0+-(DN)|
|                                                                                 |PRESET:    180|    |
|                                                                                 |ACCUM:       0|    |
|                                                                                 +--------------+    |
T4:80 - TON - File #2 MAIN_PRGRM -  396
T4:80.DN - ] [ - File #2 MAIN_PRGRM -  397
```

```
        -(U)- - File #2 MAIN_PRGRM    ͵1
Rung #397
|POLYCOLD                                                         POLYCOLD |
|SETPOINT HIGH                                                    DEFROST  |
|PCSPH                                                            PCDEF    |
|     I:002                                                         O:074  |
|------| |---------------------------------------------------------(U)-----|
|       01                                                            12   |
O:074/12 - -| |- - File #2 MAIN_PRGRM -  395,398
           -|/|- - File #2 MAIN_PRGRM -  399
           -(L)- - File #2 MAIN_PRGRM -  394
           -(U)- - File #2 MAIN_PRGRM -  397
Rung #398
|POLYCOLD WATER   POLYCOLD                                  POLYCOLD        |
|ON               DEFROST                                   COMPRESSOR ON   |
|PC_H2O           PCDEF                                     PCCOMP          |
|     I:066       O:074                                        O:074        |
|------| |----------+---| |----+----------------------------------( )-------|
|       10         |    12     |                                 10         |
|                  |[397]      |                                            |
|                  |POLYCOLD COOL|                                          |
|                  |PC_COOL    |                                            |
|                  |     O:074 |                                            |
|                  +-----| |---+                                            |
|                         11                                                 |
|                 [399]                                                      |
Rung #399
|CHROME      DWELL 1                                                        |
|CHAMBER     CHAMBER                                                        |
|=<250       GATE VALVE    POLYCOLD                                         |
|MICRONS     CLOSED        DEFROST                          POLYCOLD COOL   |
|PIR6        HV3S1         PCDEF                            PC_COOL         |
|  I:024       I:004        O:074                              O:074        |
|----| |----+----|/|----+-----|/|----------------------------------( )-------|
|      07   |      03   |      12                               11          |
|           |           |  [397]                                            |
|           |DWELL 2    |                                                   |
|           |CHAMBER    |                                                   |
|           |GATE VALVE |                                                   |
|           |CLOSED     |                                                   |
|           |HV4S1      |                                                   |
|           |   I:022   |                                                   |
|           +-----|/|---+                                                   |
|           |      06   |                                                   |
|           |HEATER 3   |                                                   |
|           |CHAMBER    |                                                   |
|           |GATE VALVE |                                                   |
|           |CLOSED     |                                                   |
|           |HV5S1      |                                                   |
|           |   I:024   |                                                   |
|           +-----|/|---+                                                   |
|                  00                                                       |
O:074/11 - -| |- - File #2 MAIN_PRGRM -  398
           -( )- - File #2 MAIN_PRGRM -  399
```

Rung #400

```
|VENT 3                                                              VENT 3 STAGE1
|STAGE 1                                                             DELAY TIMER
|V3ST1                                                               V3DYTMR
|  B3                                                                +-TON-----------------+
+--| |---------------------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  416                                                               |TIMER:        T4:20|
|[423]                                                               |BASE (SEC):   1.0 +-(DN)
|                                                                    |PRESET:          5|
|                                                                    |ACCUM:           0|
|                                                                    +-------------------+
T4:20.DN - -| |- - File #2 MAIN_PRGRM - 401
```

Rung #401

```
|                        DWELL 3      DWELL 4      BUFFER 3
|                        CHAMBER      CHAMBER      CHAMBER                        OPEN
| READY TO               GATE VALVE   GATE VALVE   GATE VALVE                     DWELL 3
| VENT                   CLOSED       CLOSED       CLOSED                         VENT VALVE
| RTVCVDT                HV6S1        HV7S1        HV8S1                          CV3
|   T4:0                  I:024        I:036        I:040                          O:027
+-+--| |---------------+----| |----------| |----------| |-----------------------------(L)-----
| |   DN               |     03           06           00                             16
| |[392]               |
| |                    | O:027/16 - -| |- - File #5 FAULTS - 148
| |                    |                    File #6 TECH_RUNGS - 0
| |                    |           -|/|- - File #2 MAIN_PRGRM - 368
| |                    |                    File #5 FAULTS - 150
| |CHAMBER VENT 3      |           -(U)- - File #2 MAIN_PRGRM - 53
| |ENABLE DELAY        |
| |V3DYTMR             |
| |    T4:20           |
| +-----| |------------+
| |     DN             |
| |[400]               |
| |MANUAL              |
| |CONTROL   HEATER 3  |
| |CHAMBER   CHAMBER   |
| |VENT 3    GATE VALVE|
| |OPEN      CLOSED    |
| |M-CV3-1   HV5S1     |
| |  N7:6     I:024    |
| +--| |---+---| |---+-+
|     13   |    00   |
| [3]      |         |
|          |DOOR 6   |
|          |CLOSED   |
|          |DRCL6S   |
|          | I:026   |
|          +--| |----+
|              02
```

Rung #402

```
|                                                                    VENT 4 STAGE1
|VENT 4                                                              VENT 4 DELAY
|STAGE 1                                                             TIMER
|V4ST1                                                               V4CV4DYTMR
|  B3                                                                +-TON-----------------+
+--| |---------------------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  418                                                               |TIMER:        T4:29|
|[428]                                                               |BASE (SEC):   1.0 +-(DN)
|                                                                    |PRESET:          5|
|                                                                    |ACCUM:           0|
|                                                                    +-------------------+
T4:29.DN - -| |- - File #2 MAIN_PRGRM - 403
```

Rung #403

```
|                          DWELL 5     DWELL 6     BUFFER 4                                   |
|                          CHAMBER     CHAMBER     CHAMBER                          OPEN       |
| READY TO                 GATE VALVE  GATE VALVE  GATE VALVE                       DWELL 5    |
| VENT                     CLOSED      CLOSED      CLOSED                           VENT VALVE |
| RTVCVDT                  HV9S1       HV10S1      HV11S1                           CV4        |
|   T4:0                    I:040       I:052       I:054                            O:043     |
|---| |--------------------+---| |-------| |--------| |-----------------------------(L)-------|
| |  DN                    |   03          06         00                              16      |
| |[392]                   |                                                                  |
| |                        | O:043/16 - -| |- - File #5 FAULTS - 152                          |
| |                        |                    File #6 TECH_RUNGS - 0                       |
| |                        |          -|/|- - File #2 MAIN_PRGRM - 368                        |
| |CHAMBER VENT 4          |                    File #5 FAULTS - 154                         |
| |ENABLE TIME             |          -(U)- - File #2 MAIN_PRGRM - 55                         |
| |DELAY                   |                                                                  |
| |V4CV4DYTMR              |                                                                  |
| |     T4:29              |                                                                  |
| |------| |---------------|                                                                  |
| |       DN               |                                                                  |
| |[402]                   |                                                                  |
| |MANUAL                  |                                                                  |
| |CONTROL    BUFFER 3     |                                                                  |
| |CHAMBER    CHAMBER      |                                                                  |
| |VENT 4     GATE VALVE   |                                                                  |
| |OPEN       CLOSED       |                                                                  |
| |M-CV4-1    HV8S1        |                                                                  |
| |  N7:6       I:040      |                                                                  |
| |---| |----+---| |-------|                                                                  |
|     14     |    00     |                                                                    |
|  [3]       |           |                                                                    |
|            |DOOR 8     |                                                                    |
|            |CLOSED     |                                                                    |
|            |DRCL8S     |                                                                    |
|            |  I:042    |                                                                    |
|            |---| |-----|                                                                    |
|                 02                                                                           |
```

Rung #404

```
|LLOCK        DWELL 1      DWELL 3      DWELL 5      EXLOCK                        ALL        |
|CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER                       CHAMBERS   |
|PRESSUR AT   PRESSUR AT   PRESSUR AT   PRESSUR AT   PRESSUR AT                    AT         |
|ATMOSPHERE   ATMOSPHERE   ATMOSPHERE   ATMOSPHERE   ATMOSPHERE                    ATMOSPHERE |
|PS2          PS3          PS4          PS5          PS6                           CH@ATMOS   |
|  I:002        I:002        I:022        I:036        I:052                          B3      |
|---| |----------| |----------| |----------| |----------| |----------------------------( )-----|
|    04           05           04           04           04                           383     |
B3/383 - -| |- - File #2 MAIN_PRGRM - 368
         -( )- - File #2 MAIN_PRGRM - 404
```

Rung #405

```
|           PUMPDOWN                 AUTO                                                    |
|VENT AREA  SYSTEM     PUMP AREA    MODE                                      VENT AREA      |
|1          ENABLE     1 ENABLE     ENABLE                                    1 ENABLE       |
|TS14       PDSE       PUMP1E       AUTO                                      VENT1E         |
|  N7:16      B3         N7:37       N7:37                                       N7:37       |
|---| |-------|/|--------|/|---------|/|---[AFI]--------------------------------------(L)-----|
|    6       303         13          11                                             6        |
|[3]        [23]       [434]       [158]                                                     |
N7:37/6 - -| |- - File #2 MAIN_PRGRM - 34,110,200,216,406,408,409,684
          -|/|- - File #2 MAIN_PRGRM - 23,115,117,118,375,434
          -(L)- - File #2 MAIN_PRGRM - 405
          -(U)- - File #2 MAIN_PRGRM - 410
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
```

```
N7:37/13 - -| |- - File #2 MAIN_PRGRM    26,27,105,167,183,200,216,408,435,436,455
           -|/|- - File #2 MAIN_PRGRM -  369,405
           -(L)- - File #2 MAIN_PRGRM -  434
           -(U)- - File #2 MAIN_PRGRM -  437
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #435

```
|PUMP AREA  VENT AREA                                                    PUMP SECTION 1       |
|1 ENABLE   ACTIVE                                                       TIMER                |
|PUMP1E     VNTACT                                                       PMP1TMR              |
|  N7:37      B3                                                         +-TON-----------+    |
|---| |-------|/|--------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|    13       343                                                        |TIMER:  T4:256 |    |
|[434]                                                                   |BASE (SEC): 1.0+-(DN) |
|                                                                        |PRESET:    600 |    |
|                                                                        |ACCUM:       0 |    |
|                                                                        +---------------+    |
T4:256.DN - -| |- - File #2 MAIN_PRGRM -  609
```

Rung #436

```
|                                                                    LLOCK                       |
|          ENABLE      ENABLE      OPEN                               CHAMBER                     |
|          CRYO        CRYO        LOAD LOCK                          ROUGH                       |
|PUMP AREA COMPRESSOR  COMPRESSOR  CHAMBER     DOOR 1  DOOR 3  DOOR 4 VALVE            PUMP 1    |
|1 ENABLE  1           2           VENT VALVE  CLOSED  OPEN    CLOSED CLOSED           STAGE 1   |
|PUMP1E    CY1         CY2         CV1         DRCL1S  DROP3S  DRCL4S RVS1             P1ST1     |
|  N7:37    O:010       O:010       O:007      I:006   I:006   I:006   I:002             B3      |
|---| |------| |---------| |---------|/|--------| |-----| |-----| |-----| |---------------( )----|
|    13       04          05          16        00      05      06      15               422     |
|[437]     [26]        [27]        [177]                                                        |
B3/422 - -| |- - File #2 MAIN_PRGRM -  68,115,117,118,437
       -( )- - File #2 MAIN_PRGRM -  436
```

Rung #406

VENT AREA 1 ENABLE VENT1E N7:37 6 [405]

VENT SECTION 1 TIMER VNT1TMR

TON
TIMER ON DELAY (EN)
TIMER: T4:168
BASE (SEC): 1.0 (DN)
PRESET: 180
ACCUM: 0

T4:168.DN - ┤ ├ - File #2 MAIN_PRGRM - 608

Rung #407

PALLET DETECTED LEFT SIDE HEATER 2 SEN10 I:003 11

PALLET DETECTED RIGHT SIDE HEATER 2 SEN12 I:003 13

PALLET DETECTED LEFT SIDE DWELL 1 SEN13 I:003 14

PALLET DETECTED CENTER DWELL 1 SEN14 I:003 15

PALLET AT DOOR 4 PLT_DR4 B3 ( ) 247

B3/247 - ┤/├ - File #2 MAIN_PRGRM - 408

Rung #408

VENT AREA 1 ENABLE VENT1E N7:37 6 [410]

PUMP AREA 1 ENABLE PUMP1E N7:37 13 [434]

MANUAL CONTROL CLOSE DOOR 4 M-DRCL4 N7:10 14 [3]

PALLET AT DOOR 4 PLT_DR4 B3 247 [407]

PALLET DETECTED LEFT SIDE DWELL 1 SEN13 I:003 14

PALLET DETECTED RIGHT SIDE HEATER 2 SEN12 I:003 13

PALLET DETECTED LEFT SIDE DWELL 1 SEN13 I:003 14

PALLET DETECTED RIGHT SIDE DWELL 1 SEN15 I:003 16

PALLET DETECTED LEFT SIDE DWELL 1 SEN13 I:003 14

PALLET DETECTED RIGHT SIDE DWELL 1 SEN15 I:003 16

DOOR 4 CLOSED DRCL4S I:006 06

DOOR CLOSE SOLENOID 4 ENABLE DRCL4 O:011 ( ) 06

MANUAL CONTROL CLOSE DOOR 4 M-DRCL4 N7:10 14 [3]

PALLET AT DOOR 4 PLT_DR4 B3 247 [407]

MANUAL DOOR 4 OPEN MDR4OP N7:32 (U) 10

MANUAL DOOR 4 CLOSE MDR4CL N7:31 (L) 14

O:011/06 - ┤ ├ - File #5 FAULTS - 23

```
                File #6 TECH_RUNGS -
         -( )- - File #2 MAIN_PRGRM -  408
N7:32/10 - -(L)- - File #2 MAIN_PRGRM -  415
         -(U)- - File #2 MAIN_PRGRM -  408
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/14 - -(L)- - File #2 MAIN_PRGRM -  408
         -(U)- - File #2 MAIN_PRGRM -  415
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #409
|                                      LLOCK                               OPEN                                    |
|                                      CHAMBER  HEATER 1   HEATER 2        CAPACITANC                              |
|                                      ROUGH    CHAMBER    CHAMBER         MANOMETER                               |
|VENT AREA  DOOR 4   DOOR 2   DOOR 3   VALVE    GATE VALVE GATE VALVE      ISOLATION                      VENT 1   |
|1 ENABLE   CLOSED   OPEN     OPEN     CLOSED   CLOSE      CLOSE           VALVE 1                        STAGE 1  |
|VENT1E     DRCL4S   DROP2S   DROP3S   RVS1     HV1S1      HV2S1           CMV1                           V1ST1    |
|  N7:37    I:006    I:006    I:006    I:002    I:002      I:004           O:010                          B3       |
|---] [-----] [------] [------] [------] [------] [--------] [-------------]/[-----------------------------( )------|
|    6        06       03       05       15       06         00              06                            412     |
|[410]                                                                     [375]                                  |
B3/412 - ] [ - File #2 MAIN_PRGRM -  171,410
       -( )- - File #2 MAIN_PRGRM -  409
Rung #410
|          LLOCK                                                                                                  |
|          CHAMBER                                                                                                |
|  VENT 1  PRESSUR AT                                                                                VENT AREA    |
|  STAGE 1 ATMOSPHERE                                                                                1 ENABLE     |
|  V1ST1   PS2                                                                                       VENT1E       |
|   B3       I:002                                                                                    N7:37       |
|-+---] [-------] [-----+---------------------------------------------------------------------------(U)---------|
| |  412         04     |                                                                              6          |
| |[409]                |                                                                                         |
| |                     | N7:37/6 - ] [ - File #2 MAIN_PRGRM - 34, 110, 200, 216, 406, 408, 409, 684               |
| |                     |         ]/[ - File #2 MAIN_PRGRM - 23, 115, 117, 118, 375, 434                           |
| |                     |         -(L)- - File #2 MAIN_PRGRM - 405                                                 |
| |                     | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                                              |
| |ABORT SYSTEM         |                                                                                         |
| |VENT                 |                                                                                         |
| |BORT_SYS_VNT         |                                                                                         |
| |   N7:17             |                                                                                         |
| |----] [--------------|                                                                                         |
| |     10              |                                                                                         |
| |[3]                  |                                                                                         |
| |PREPARE FOR          |                                                                                         |
| |AUTO RUN             |                                                                                         |
| |>AUTO                |                                                                                         |
| |   N7:37             |                                                                                         |
| +----] [--------------+                                                                                         |
|       1                                                                                                         |
|  [162]                                                                                                          |
Rung #411
|        PUMPDOWN             AUTO                                                                                |
|AREA 2  SYSTEM   PUMP AREA   MODE                                                                  VENT AREA     |
|VENT    ENABLE   2 ENABLE    ENABLE                                                                2 ENABLE      |
|TS15    PDSE     PUMP2E      AUTO                                                                  VENT2E        |
| N7:16    B3       N7:37     N7:37                                                                   N7:37       |
|---] [----]/[-------]/[-------]/[---[AFI]----------------------------------------------------------(L)---------|
|   7      303       14         11                                                                     7          |
|[3]     [23]      [438]      [158]                                                                               |
N7:37/7 - ] [ - File #2 MAIN_PRGRM -  35,111,229,412,414,415,416
          ]/[ - File #2 MAIN_PRGRM -  23,117,118,119,120,121,122,123,124,376,438
          -(L)- - File #2 MAIN_PRGRM -  411
          -(U)- - File #2 MAIN_PRGRM -  417
```

_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM 2

Rung #412

VENT AREA
2 ENABLE
VENT2E
N7:37
7
[411]

VENT SECTION 2
TIMER
VNT2TMR
TON
TIMER ON DELAY (EN)
TIMER: T4:199
BASE (SEC): 1.0 (DN)
PRESET: 300
ACCUM: 0

T4:199.DN - ┤ ├ - File #2 MAIN_PRGRM - 608

Rung #413

PALLET CENTER BUFFER 2 SEN23 I:023 07
PALLET DETECTED RIGHT SIDE HEATER 3 SEN24 I:023 10
PALLET DETECTED LEFT SIDE DWELL 3 SEN25 I:023 11
PALLET DETECTED CENTER DWELL 3 SEN26 I:023 12

B3/249 - ┤/├ - File #2 MAIN_PRGRM - 414, 420

PALLET AT DOOR 5 AND 6 PLT_DR5,6 B3 ( ) 249

Rung #414

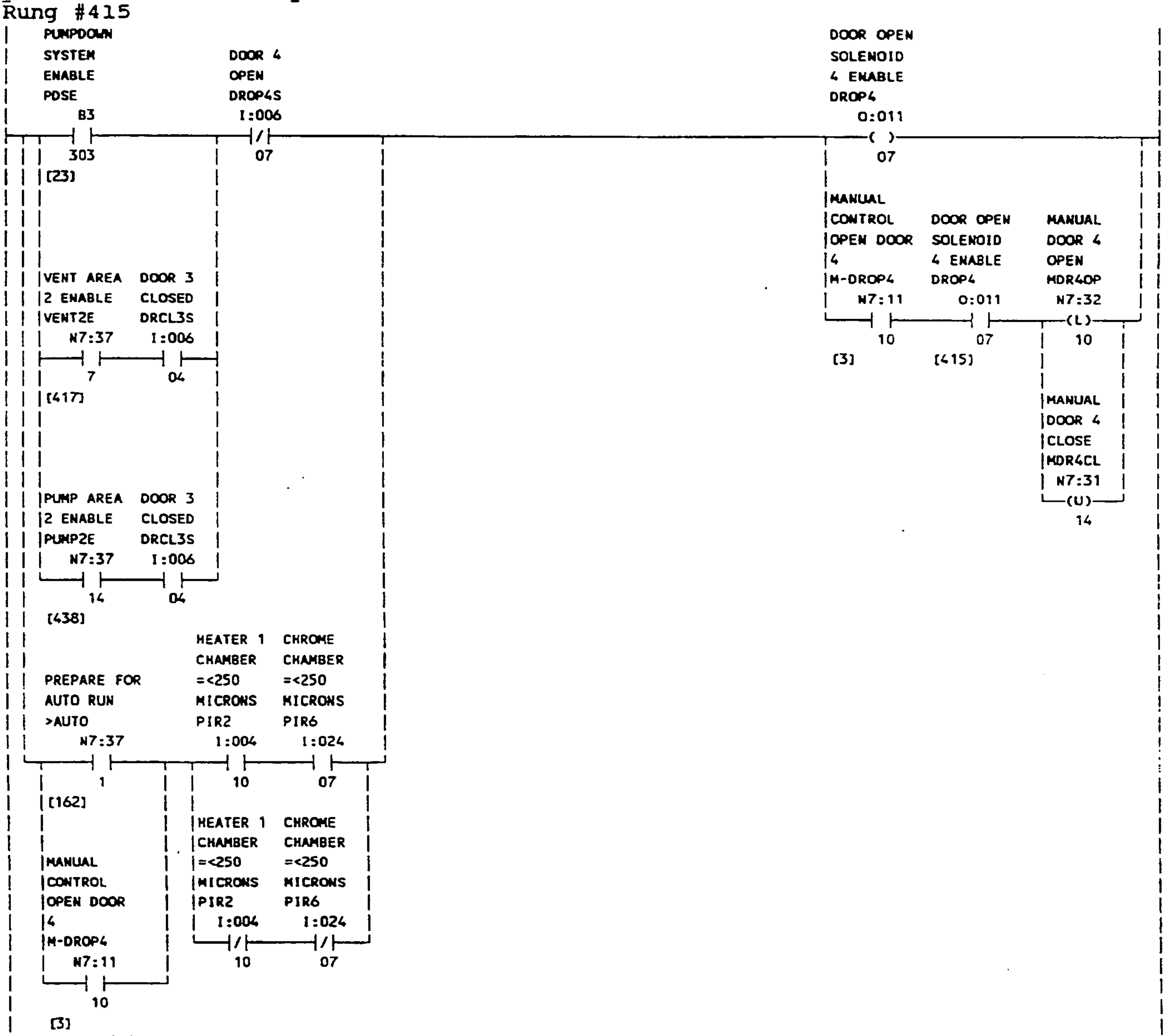
VENT AREA 2 ENABLE VENT2E N7:37 7 [411]
PUMP AREA 2 ENABLE PUMP2E N7:37 14 [438]
PALLET DETECTED LEFT SIDE HEATER 3 SEN22 I:023 /06
PALLET DETECTED RIGHT SIDE HEATER 3 SEN24 I:023 /10
PALLET DETECTED LEFT SIDE DWELL 3 SEN25 I:023 11
PALLET DETECTED RIGHT SIDE DWELL 3 SEN27 I:023 13
PALLET DETECTED LEFT SIDE DWELL 3 SEN25 I:023 /11
PALLET DETECTED RIGHT SIDE DWELL 3 SEN27 I:023 /13
DOOR 5 CLOSED DRCL5S I:026 /00
MANUAL CONTROL CLOSE DOOR 5 M-DRCL5 N7:10 15 [3]
PALLET AT DOOR 5 AND 6 PLT_DR5,6 B3 /249 [413]

DOOR CLOSE SOLENOID 5 ENABLE DRCL5 O:031 ( ) 00

MANUAL CONTROL CLOSE DOOR 5 M-DRCL5 N7:10 15 [3]
PUMP AREA 5 ENABLE PUMP5E N7:38 /1 [451]
MANUAL DOOR 5 OPEN MDR5OP N7:32 (U) 11
MANUAL DOOR 5 CLOSE MDR5CL N7:31 (L) 15

```
O:031/00 - ┤ ├ - File #5 FAULTS -  2
                 File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  414
N7:32/11 - -(L)- - File #2 MAIN_PRGRM -  46
         -(U)- - File #2 MAIN_PRGRM -  414
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/15 - -(L)- - File #2 MAIN_PRGRM -  414
         -(U)- - File #2 MAIN_PRGRM -  46
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

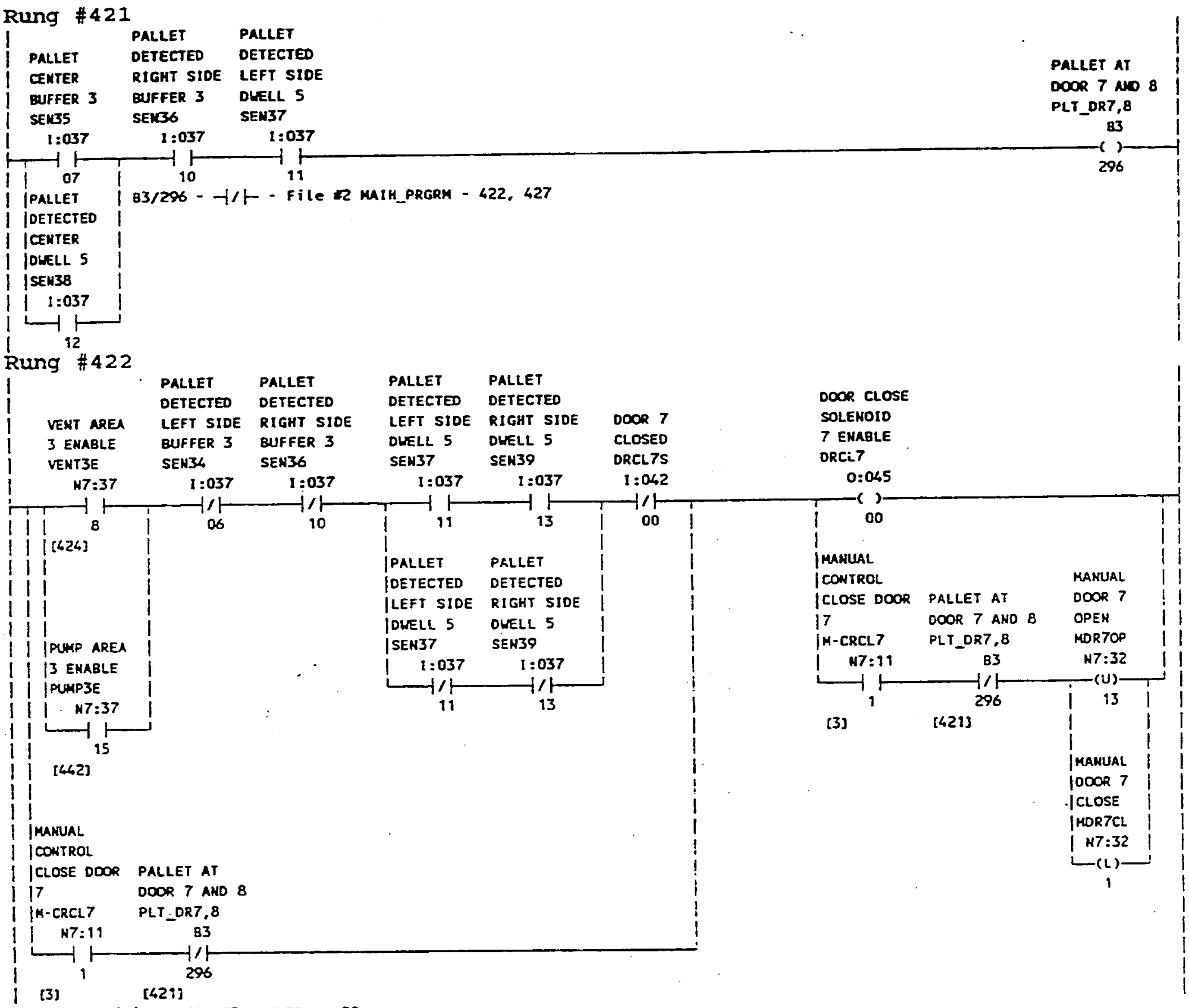
Rung #415




```
O:011/07 - ┤ ├ - File #2 MAIN_PRGRM -  415
                 File #5 FAULTS -  47
```

```
                    File #6 TECH_RUNGS    2
            -( )- - File #2 MAIN_PRGRM -  415
N7:32/10 - -(L)- - File #2 MAIN_PRGRM -  415
            -(U)- - File #2 MAIN_PRGRM -  408
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/14 - -(L)- - File #2 MAIN_PRGRM -  408
            -(U)- - File #2 MAIN_PRGRM -  415
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #416
VENT AREA DOOR 3  DOOR 4  DOOR 5  HEATER 2    DWELL 1     DWELL 2     HEATER 3    OPEN         RGA 2     DWELL 2      VENT 2
2 ENABLE  CLOSED  OPEN    CLOSED  CHAMBER     CHAMBER     CHAMBER     CHAMBER     CAPACITANC   ISOLATION CHAMBER      STAGE 1
VENT2E    DRCL3S  DROP4S  DRCL5S  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  MANOMETER    VALVE     ROUGH        V2ST1
                                  CLOSE       CLOSED      CLOSED      CLOSED      ISOLATION    CLOSED    VALVE RV2
                                  HV2S1       HV3S1       HV4S1       HV5S1       VALVE 2      RGAS3     CLOSED
                                                                                  CHV2                   RVS3
 N7:37    I:006   I:006   I:026   I:004       I:004       I:022       I:024       O:030        I:025     I:022        B3
--] [------] [-----] [-----] [-----] [----------] [---------] [---------] [---------]/[----------] [-------] [---------( )--
   7       04      07      00      00          03          06          00          06          16         15          414
                                                                                  [376]
[417]
B3/414 - -] [- - File #2 MAIN_PRGRM -  393,417
         -( )- - File #2 MAIN_PRGRM -  416
Rung #417
          DWELL 1      DWELL 1
          CHAMBER      CHAMBER                                              VENT AREA
 VENT 2   PRESSUR AT   VENT VALVE                                           2 ENABLE
 STAGE 1  ATMOSPHERE   OPEN                                                 VENT2E
 V2ST1    PS3          CVS4                                                   N7:37
   B3      I:002        I:002
--+--] [-------] [----------] [--+------------------------------------------(U)--
  |  414       05            14  |                                            7
  | [416]                        |
  |                              | N7:37/7 - -] [- - File #2 MAIN_PRGRM - 35, 111, 229, 412, 414, 415, 416
  |                              |           -]/[- - File #2 MAIN_PRGRM - 23, 117, 118, 119, 120, 121, 122, 123, 124,
  |                              |                   376, 438
  |                              |           -(L)- - File #2 MAIN_PRGRM - 41?
  |ABORT SYSTEM                  | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
  |VENT                          |
  |BORT_SYS_VNT                  |
  |   N7:17                      |
  +----] [-----------------------+
  |    10                        |
  |[3]                           |
  |PREPARE FOR                   |
  |AUTO RUN                      |
  |>AUTO                         |
  |   N7:37                      |
  +----] [-----------------------+
       1
 [162]
Rung #418
          PUMPDOWN             AUTO
AREA 3    SYSTEM    PUMP AREA  MODE                                          VENT AREA
VENT      ENABLE    3 ENABLE   ENABLE                                        3 ENABLE
TS16      POSE      PUMP3E     AUTO                                          VENT3E
 N7:16     B3        N7:37     N7:37                                          N7:37
--] [------]/[-------]/[-------]/[--[AFI]-----------------------------------(L)--
   8       303       15        11                                               8
[3]       [23]      [442]     [158]
N7:37/8 - -] [- - File #2 MAIN_PRGRM -  36,43,112,419,420,422,423
          -]/[- - File #2 MAIN_PRGRM -  23,125,126,127,128,129,130,377,442
          -(L)- - File #2 MAIN_PRGRM -  418
          -(U)- - File #2 MAIN_PRGRM -  424
```

```
_F:N7:211X21 - BTW - File #2 MAIN_PRG    2
Rung #419
|VENT AREA                                                  VENT SECTION 3
|3 ENABLE                                                   TIMER
|VENT3E                                                     VNT3TMR
|  N7:37                                                    +--TON--------------+
|---| |-----------------------------------------------------|TIMER ON DELAY     |-(EN)-
|    8                                                      |TIMER:      T4:242 |
|[418]                                                      |BASE (SEC):    1.0 |-(DN)
|                                                           |PRESET:        300 |
|                                                           |ACCUM:           0 |
|                                                           +-------------------+
T4:242.DN - -| |- - File #2 MAIN_PRGRM -  608
Rung #420
|            PALLET     PALLET      PALLET     PALLET
|            DETECTED   DETECTED    DETECTED   DETECTED                  DOOR CLOSE
|  VENT AREA LEFT SIDE  RIGHT SIDE  LEFT SIDE  RIGHT SIDE  DOOR 6        SOLENOID
|  3 ENABLE  HEATER 3   HEATER 3    DWELL 3    DWELL 3     CLOSED        6 ENABLE
|  VENT3E    SEN22      SEN24       SEN25      SEN27       DRCL6S        DRCL6
|    N7:37    I:023      I:023       I:023      I:023      I:026          O:031
|----| |------|/|--------|/|---------|/|--------|/|--------|/|------------( )-----
|       8       06        10           11         13         02            02
|  [418]                            |PALLET     PALLET                |MANUAL
|                                   |DETECTED   DETECTED              |CONTROL                        MANUAL
|                                   |LEFT SIDE  RIGHT SIDE            |CLOSE DOOR  PALLET AT          DOOR 6
|                                   |DWELL 3    DWELL 3               |6           DOOR 5 AND 6       OPEN
|  |PUMP AREA                       |SEN25      SEN27                 |M-DRCL6     PLT_DR5,6          MDR6OP
|  |3 ENABLE                        |  I:023      I:023               |  N7:11         B3             N7:32
|  |PUMP3E                          +---| |-------| |---              +---| |---------|/|-------------(U)---
|  |  N7:37                               11         13                     0           249               12
|  +---| |---                                                        [3]          [413]
|        15                                                                                       |MANUAL
|  [442]                                                                                          |DOOR 6
|                                                                                                 |CLOSE
|MANUAL                                                                                           |MDR6CL
|CONTROL                                                                                          | N7:32
|CLOSE DOOR  PALLET AT                                                                            +--(L)---
|6           DOOR 5 AND 6                                                                              0
|M-DRCL6     PLT_DR5,6
|  N7:11        B3
+---| |---------|/|-----
      0         249
  [3]          [413]
O:031/02 - -| |- - File #5 FAULTS -  27
                   File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  420
N7:32/12 - -(L)- - File #2 MAIN_PRGRM -  47
         -(U)- - File #2 MAIN_PRGRM -  420
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/0 - -(L)- - File #2 MAIN_PRGRM -  420
        -(U)- - File #2 MAIN_PRGRM -  47
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
```



O:045/00 - -| |- - File #5 FAULTS - 29
File #6 TECH_RUNGS - 3
-( )- - File #2 MAIN_PRGRM - 422
N7:32/13 - -(L)- - File #2 MAIN_PRGRM - 48
-(U)- - File #2 MAIN_PRGRM - 422
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
N7:32/1 - -(L)- - File #2 MAIN_PRGRM - 422
-(U)- - File #2 MAIN_PRGRM - 48
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2

Rung #423

```
                                      DWELL 3     DWELL 4     BUFFER 3    DWELL 2     RGA 2       OPEN
                                      CHAMBER     CHAMBER     CHAMBER     CHAMBER     ISOLATION   CAPACITANC
VENT AREA   DOOR 6      DOOR 7        GATE VALVE  GATE VALVE  GATE VALVE  ROUGH       VALVE       MANOMETER                VENT 3
3 ENABLE    CLOSED      CLOSED        CLOSED      CLOSED      CLOSED      VALVE RV2   CLOSED      ISOLATION                STAGE 1
VENT3E      DRCL6S      DRCL7S        HV6S1       HV7S1       HV8S1       CLOSED      RGAS3       VALVE 3                  V3ST1
N7:37       I:026       I:042         I:024       I:036       I:040       RVS3        I:025       CMV3                     B3
                                                                          I:022                   O:044
--| |-------| |---------| |-----------| |---------| |---------| |---------| |---------| |---------|/|--------------------( )--
  8         02          00            03          06          00          15          16          06                       416
[424]                                                                                             [377]
B3/416 - -| |- - File #2 MAIN_PRGRM -  400,424
         -( )- - File #2 MAIN_PRGRM -  423
```

Rung #424

```
            DWELL 3      DWELL 3
            CHAMBER      CHAMBER
 VENT 3     PRESSUR AT   VENT VALVE                                                                     VENT AREA
 STAGE 1    ATMOSPHERE   OPEN                                                                           3 ENABLE
 V3ST1      PS4          CVS6                                                                           VENT3E
 B3         I:022        I:022                                                                          N7:37
--+--| |--------| |----------| |-------+------------------------------------------------------------------(U)--
  |  416        04           12        |                                                                 8
  | [423]                              |
  |                                    | N7:37/8 - -| |- - File #2 MAIN_PRGRM - 36, 43, 112, 419, 420, 422, 423
  |                                    |           -|/|- - File #2 MAIN_PRGRM - 23, 125, 126, 127, 128, 129, 130, 377, 442
  |                                    |           -(L)- - File #2 MAIN_PRGRM - 418
  |                                    | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
  |ABORT SYSTEM                        |
  |VENT                                |
  |BORT_SYS_VNT                        |
  |     N7:17                          |
  +-----| |----------------------------+
  |     10                             |
  |[3]                                 |
  |PREPARE FOR                         |
  |AUTO RUN                            |
  |>AUTO                               |
  |     N7:37                          |
  +-----| |----------------------------+
        1
 [162]
```

Rung #425

```
        PUMPDOWN               AUTO
AREA 4  SYSTEM     PUMP AREA   MODE                                                  VENT AREA
VENT    ENABLE     4 ENABLE    ENABLE                                                4 ENABLE
TS17    PDSE       PUMP4E      AUTO                                                  VENT4E
N7:16   B3         N7:38       N7:37                                                 N7:37
--| |-----|/|--------|/|---------|/|---[AFI]--------------------------------------------(L)--
  9       303        0           11                                                    9
[3]     [23]       [447]       [158]
N7:37/9 - -| |- - File #2 MAIN_PRGRM -  37,113,329,426,427,428
          -|/|- - File #2 MAIN_PRGRM -  23,131,132,133,134,135,136,378,447
          -(L)- - File #2 MAIN_PRGRM -  425
          -(U)- - File #2 MAIN_PRGRM -  429
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #426

VENT AREA 4 ENABLE VENT4E N7:37 9 [425] — VENT SECTION 4 TIMER VNT4TMR TON TIMER ON DELAY (EN) TIMER: T4:248 BASE (SEC): 1.0 (DN) PRESET: 300 ACCUM: 0

T4:248.DN - ┤ ├ - File #2 MAIN_PRGRM - 608

Rung #427

VENT AREA 4 ENABLE VENT4E N7:37 9 [425]; PUMP AREA 4 ENABLE PUMP4E N7:38 0 [447]; MANUAL CONTROL CLOSE DOOR 8 M-CRCL8 N7:11 2 [3]; PALLET DETECTED LEFT SIDE BUFFER 3 SEN34 I:037 06 (/); PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36 I:037 10 (/); PALLET DETECTED LEFT SIDE DWELL 5 SEN37 I:037 11; PALLET DETECTED RIGHT SIDE DWELL 5 SEN39 I:037 13; PALLET DETECTED LEFT SIDE DWELL 5 SEN37 I:037 11 (/); PALLET DETECTED RIGHT SIDE DWELL 5 SEN39 I:037 13 (/); DOOR 8 CLOSED DRCL8S I:042 02 (/); MANUAL CONTROL CLOSE DOOR 8 M-CRCL8 N7:11 2 [3]; PALLET AT DOOR 7 AND 8 PLT_DR7,8 83 296 (/) [421] — DOOR CLOSE SOLENOID 8 ENABLE DRCL8 O:045 02 ( ); MANUAL CONTROL CLOSE DOOR 8 M-CRCL8 N7:11 2 [3]; PALLET AT DOOR 7 AND 8 PLT_DR7,8 83 296 (/) [421] — MANUAL DOOR 8 OPEN MDR8OP N7:32 (U) 14; MANUAL DOOR 8 CLOSE MDR8CL N7:32 (L) 2

O:045/02 - ┤ ├ - File #5 FAULTS - 31
File #6 TECH_RUNGS - 3
-( )- - File #2 MAIN_PRGRM - 427
N7:32/14 - -(L)- - File #2 MAIN_PRGRM - 49
-(U)- - File #2 MAIN_PRGRM - 427
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2
N7:32/2 - -(L)- - File #2 MAIN_PRGRM - 427
-(U)- - File #2 MAIN_PRGRM - 49
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2

```
Rung #428
                                            DWELL 5              OPEN
                       DWELL 5    DWELL 6    BUFFER 4   CHAMBER  RGA 4     CAPACITANC
                       CHAMBER    CHAMBER    CHAMBER    ROUGH    ISOLATION MANOMETER
VENT AREA DOOR 8 DOOR 9 GATE VALVE GATE VALVE GATE VALVE VALVE   VALVE     ISOLATION          VENT 4
4 ENABLE  CLOSED CLOSED CLOSED     CLOSED     CLOSED     CLOSED  CLOSED    VALVE 4            STAGE 1
VENT4E    DRCL8S DRCL9S HV9S1      HV10S1     HV11S1     RVS7    RGAS7     CMV4               V4ST1
 N7:37    I:042  I:056  I:040      I:052      I:054      I:052   I:055     O:060              B3
--] [------] [---] [----] [--------] [--------] [--------] [------] [------]/[----------------( )--
  9        02     00     03         06         00         14      16        06                418
[429]                                                                     [378]
B3/418 - ] [ - File #2 MAIN_PRGRM - 402,429
        -( )- - File #2 MAIN_PRGRM - 428
Rung #429
         DWELL 5     DWELL 5
         CHAMBER     CHAMBER
 VENT 4  VENT VALVE  PRESSUR AT                                              VENT AREA
 STAGE 1 OPEN        ATMOSPHERE                                              4 ENABLE
 V4ST1   CVS8        PS5                                                     VENT4E
  B3      I:036       I:036                                                  N7:37
--] [------] [---------] [---+-------------------------------------------------(U)--
  418       12          04   |                                                 9
 [428]                       |
                             | N7:37/9 - ] [ - File #2 MAIN_PRGRM - 37, 113, 329, 426, 427, 428
                             |           ]/[ - File #2 MAIN_PRGRM - 23, 131, 132, 133, 134, 135, 136, 378, 447
                             |           -(L)- - File #2 MAIN_PRGRM - 425
                             | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
 |ABORT SYSTEM               |
 |VENT                       |
 |BORT_SYS_VNT               |
 |  N7:17                    |
 +---] [---------------------+
      10                     |
 [3]                         |
 |PREPARE FOR                |
 |AUTO RUN                   |
 |>AUTO                      |
 |  N7:37                    |
 +---] [---------------------+
      1
 [162]
Rung #430
       PUMPDOWN             AUTO
AREA 5 SYSTEM   PUMP AREA  MODE                                             VENT AREA
VENT   ENABLE   5 ENABLE   ENABLE                                           5 ENABLE
TS18   PDSE     PUMP5E     AUTO                                             VENT5E
N7:16   B3       N7:38     N7:37                                            N7:37
--] [----]/[------]/[------]/[---[AFI]--------------------------------------(L)--
  10     303      1        11                                               10
[3]     [23]    [451]     [158]
N7:37/10 - ] [ - File #2 MAIN_PRGRM - 114,327,335,431,432,698
           ]/[ - File #2 MAIN_PRGRM - 23,137,138,451
          -(L)- - File #2 MAIN_PRGRM - 430
          -(U)- - File #2 MAIN_PRGRM - 433
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
```

```
Rung #431
|VENT AREA                                                    VENT SECTION 5  |
|5 ENABLE                                                     TIMER           |
|VENT5E                                                       VNT5TMR         |
|  N7:37                                                      +-TON---------+ |
|---] [-------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|    10                                                       |TIMER:  T4:252| |
|[430]                                                        |BASE (SEC): 1.0|-(DN)|
|                                                             |PRESET:    180| |
|                                                             |ACCUM:       0| |
|                                                             +--------------+ |
T4:252.DN - ] [ - File #2 MAIN_PRGRM - 608
Rung #432
|            EXLOCK                                                           |
|            CHAMBER   EXITLOCK                                               |
|            ROUGH     CHAMBER                                                |
|VENT AREA   VALVE     GATE VALVE  DOOR 10   DOOR 11                  VENT 5  |
|5 ENABLE    CLOSED    CLOSED      CLOSED    OPEN                     STAGE 1 |
|VENT5E      RVS9      HV12S1      DRCL10S   DROP11S                  V5ST1   |
|  N7:37     I:052     I:054       I:056     I:056                    B3      |
|---] [------] [--------] [-----------] [------] [---------------------( )----|
|    10        16        03          02        05                      420    |
|[433]
B3/420 - ] [ - File #2 MAIN_PRGRM - 344,351,433
        -( )- - File #2 MAIN_PRGRM - 432
Rung #433
|            EXLOCK                                                           |
|            CHAMBER                                                          |
|  VENT 5    PRESSUR AT                                            VENT AREA  |
|  STAGE 1   ATMOSPHERE                                            5 ENABLE   |
|  V5ST1     PS6                                                   VENT5E     |
|    B3        I:052                                                N7:37     |
|-+---] [-------] [---+---------------------------------------------(U)-------|
| |   420         04  |                                              10       |
| |[432]              |                                                       |
| |                   | N7:37/10 - ] [ - File #2 MAIN_PRGRM - 114, 327, 335, 431, 432, 698
| |                   |          ]/[ - File #2 MAIN_PRGRM - 23, 137, 138, 451
| |                   |          -(L)- - File #2 MAIN_PRGRM - 430
| |                   | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2
| |ABORT SYSTEM       |                                                       |
| |VENT               |                                                       |
| |BORT_SYS_VNT       |                                                       |
| |    N7:17          |                                                       |
| +------] [----------+                                                       |
| |      10           |                                                       |
| |[3]                |                                                       |
| |PREPARE FOR        |                                                       |
| |AUTO RUN           |                                                       |
| |>AUTO              |                                                       |
| |    N7:37          |                                                       |
| +------] [----------+                                                       |
|         1                                                                   |
|  [162]                                                                      |
Rung #434
|           HEATER 1    HEATER 2                                              |
|           CHAMBER     CHAMBER     PIRANI              SYSTEM                 |
|PUMP AREA  GATE VALVE  GATE VALVE  GUAGE 1   DOOR 2   VENT      VENT AREA   PUMP AREA |
|1          CLOSE       CLOSE       NO FAULT  OPEN     ENABLE    1 ENABLE    1 ENABLE  |
|TS21       HV1S1       HV2S1       PGNF1     DROP2S   SYSVNTE   VENT1E      PUMP1E    |
|  N7:16     I:002       I:004       I:004     I:006    N7:37     N7:37       N7:37    |
|---] [-------] [---------] [---------] [-------] [-------]/[-------]/[--------(L)-----|
|    13        06          00          14        03        5         6           13   |
|[3]                                                    [369]     [410]               |
```

```
Rung #437
                HEATER 1     HEATER 2
                CHAMBER      CHAMBER
    PUMP 1      GATE VALVE   GATE VALVE                                              PUMP AREA
    STAGE 1     OPEN         OPEN                                                    1 ENABLE
    P1ST1       HV1S3        HV2S3                                                   PUMP1E
     B3         I:002        I:004                                                     N7:37
|--+--] [-------] [----------] [---+-----------------------------------------+--------(U)----|
|  |  422        10           02   |                                         |         13
|  |[436]                          |                                         |
|  |                               | N7:37/13 - ] [ - File #2 MAIN_PRGRM - 26, 27, 105, 167,
|  |                               |              183, 200, 216, 408, 435, 436, 455
|  |                               |            ]/[ - File #2 MAIN_PRGRM - 369, 405   PUMP1E
|  |                               |           -(L)- - File #2 MAIN_PRGRM - 434       DISABLE
|  |                               | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      PULSE
|  |ABORT PUMPDOWN                 | T4:284.TT - ] [ - File #2 MAIN_PRGRM - 84        PUMP1EDPLSE
|  |BT_PD                          |                                         +-TON-----------------+
|  |    N7:17                      |                                         +-TIMER ON DELAY      +-(EN)-
|  +----] [------------------------+                                         |TIMER:        T4:284 |
|  |      8                        |                                         |BASE (SEC):      1.0 +-(DN)
|  |[3]                            |                                         |PRESET:            5 |
|  |                               |                                         |ACCUM:             0 |
|  |PIRANI                         |                                         +---------------------+
|  |GUAGE 1                        |
|  |NO FAULT                       |
|  |PGNF1                          |
|  |  I:004                        |
|  +----]/[------------------------+
|  |    14                         |
|  |PREPARE FOR                    |
|  |AUTO RUN                       |
|  |>AUTO                          |
|  |  N7:37                        |
|  +----] [------------------------+
|       1
|  [162]
Rung #438
              HEATER 2     DWELL 1      DWELL 2      HEATER 3
              CHAMBER      CHAMBER      CHAMBER      CHAMBER      PIRANI     SYSTEM
PUMP AREA     GATE VALVE   GATE VALVE   GATE VALVE   GATE VALVE   GUAGE 2    VENT       VENT AREA                 PUMP AREA
2             CLOSE        CLOSED       CLOSED       CLOSED       NO FAULT   ENABLE     2 ENABLE                  2 ENABLE
TS22          HV2S1        HV3S1        HV4S1        HV5S1        PGNF2      SYSVNTE    VENT2E                    PUMP2E
  N7:16       I:004        I:004        I:022        I:024        I:004      N7:37      N7:37                       N7:37
|----] [--------] [----------] [----------] [----------] [----------] [--------]/[--------]/[-----------------------(L)----|
     14          00           03           06           00           15         5          7                          14
[3]                                                                             [369]      [417]
N7:37/14 - ] [ - File #2 MAIN_PRGRM -  27,28,29,30,56,73,106,229,414,415,439,440,445
           ]/[ - File #2 MAIN_PRGRM -  369,411
          -(L)- - File #2 MAIN_PRGRM -  438
          -(U)- - File #2 MAIN_PRGRM -  441
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #439
PUMP AREA                                                                        PUMP SECTION 2
2 ENABLE                                                                         TIMER
PUMP2E                                                                           PMP2TMR
  N7:37                                                                          +-TON-----------------+
|----] [-------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
     14                                                                          |TIMER:        T4:262 |
[438]                                                                            |BASE (SEC):      1.0 +-(DN)
|                                                                                |PRESET:          600 |
|                                                                                |ACCUM:             0 |
|                                                                                +---------------------+
```

```
T4:262.DN - -| |- - File #2 MAIN_PRGR.   609
Rung #440
                                                                                          DWELL 2
          ENABLE      ENABLE      ENABLE      ENABLE      DWELL 1                         CHAMBER
          CRYO        CRYO        CRYO        CRYO        CHAMBER                         ROUGH
PUMP AREA COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  VENT VALVE DOOR 3  DOOR 5  DOOR 4  VALVE RV2   PUMP2
2 ENABLE  2           3           4           5           CLOSED     CLOSED  CLOSED  OPEN    CLOSED      STAGE 1
PUMP2E    CY2         CY3         CY4         CY5         CVS3       DRCL3S  DRCL5S  DROP4S  RVS3        P2ST1
 N7:37    O:010       O:030       O:030       O:044       I:002      I:006   I:026   I:006   I:022         B3
|--| |------| |---------| |---------| |---------| |---------| |--------| |----| |----| |----| |-------------( )--|
    14        05          04          05          04          13         04      00      07      15            424
[441]     [27]        [28]        [29]        [30]
B3/424 - -| |- - File #2 MAIN_PRGRM -  117,118,119,120,121,122,123,124,441
         -( )- - File #2 MAIN_PRGRM -  440
Rung #441
          HEATER 2    DWELL 1     DWELL 2     HEATER 3
          CHAMBER     CHAMBER     CHAMBER     CHAMBER
PUMP2     GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE                         PUMP AREA
STAGE 1   OPEN        OPEN        OPEN        OPEN                               2 ENABLE
P2ST1     HV2S3       HV3S3       HV4S3       HV5S3                              PUMP2E
  B3      I:004       I:004       I:022       I:024                                N7:37
|-+--| |------| |---------| |---------| |---------| |----+--------------------+------(U)------+-|
  | 424       02          05          10          02     |                    |      14       |
  | [440]                                                |                    |               |
  |                                                      |                    |PUMP 2         |
  |                                                      |                    |END PULSE      |
  |                                                      |                    |P2ENDPULSE     |
  |ABORT PUMPDOWN                                        |                    | +-TON-------------+
  |BT_PD                                                 |                    +-|TIMER ON DELAY   |-(EN)-
  |     N7:17                                            |                      |TIMER:    T4:125 |
  +-----| |----------------------------------------------+                      |BASE (SEC):  1.0 |-(DN)
  |      8                                               |                      |PRESET:        5 |
  | [3]                                                  |                      |ACCUM:         0 |
  |                                                      |                      +-----------------+
  |PIRANI                                                |
  |GUAGE 2                                               |
  |NO FAULT                                              |
  |PGNF2                                                 |
  |   I:004                                              |
  +----|/|-----------------------------------------------+
  |     15                                               |
  |PREPARE FOR                                           |
  |AUTO RUN                                              |
  |>AUTO                                                 |
  |    N7:37                                             |
  +-----| |----------------------------------------------+
         1
   [162]
N7:37/14 - -| |- - File #2 MAIN_PRGRM -  27,28,29,30,56,73,106,229,414,415,439,440,445
           -|/|- - File #2 MAIN_PRGRM -  369,411
           -(L)- - File #2 MAIN_PRGRM -  438
           -(U)- - File #2 MAIN_PRGRM -  441
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
T4:125.TT - -| |- - File #2 MAIN_PRGRM -  91
```

```
Rung #442
|           DWELL 3      DWELL 4      BUFFER 3
|           CHAMBER      CHAMBER      CHAMBER      PIRINI     SYSTEM
|PUMP AREA  GATE VALVE   GATE VALVE   GATE VALVE   GUAGE 3    VENT      VENT AREA                         PUMP AREA |
|3          CLOSED       CLOSED       CLOSED       NO FAULT   ENABLE    3 ENABLE                          3 ENABLE  |
|TS23       HV6S1        HV7S1        HV8S1        PGNF3      SYSVNTE   VENT3E                            PUMP3E    |
|  N7:16      I:024        I:036        I:040        I:024     N7:37     N7:37                               N7:37  |
|----] [--------] [--------] [--------] [--------] [-------]/[------]/[--------------------------------------(L)----|
|    15         03           06           00           14         5         8                                 15   |
|[3]                                                          [369]     [424]                                       |
N7:37/15 - ] [ - File #2 MAIN_PRGRM -  30,31,57,73,107,420,422,443,444,445
           ]/[ - File #2 MAIN_PRGRM -  369,418
           -(L)- - File #2 MAIN_PRGRM -  442
           -(U)- - File #2 MAIN_PRGRM -  446
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #443
|PUMP AREA                                                                        PUMP SECTION 3   |
|3 ENABLE                                                                         TIMER            |
|PUMP3E                                                                           PMP3TMR          |
|  N7:37                                                                          +--TON---------+ |
|----] [--------------------------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|    15                                                                           |TIMER:  T4:288| |
|[442]                                                                            |BASE (SEC): 1.0|-(DN) |
|                                                                                 |PRESET:    600| |
|                                                                                 |ACCUM:       0| |
|                                                                                 +--------------+ |
T4:288.DN - ] [ - File #2 MAIN_PRGRM -  609
Rung #444
|                                                          DWELL 4                                 |
|           ENABLE       ENABLE       DWELL 4              CHAMBER                                 |
|           CRYO         CRYO         CHAMBER              ROUGH                                   |
|PUMP AREA  COMPRESSOR   COMPRESSOR   VENT VALVE  DOOR 6   DOOR 7   VALVE                   PUMP 3 |
|3 ENABLE   5            6            CLOSED      CLOSED   CLOSED   CLOSED                  STAGE 1 |
|PUMP3E     CY5          CY6          CVS5        DRCL6S   DRCL7S   RVS5                    P3ST1  |
|  N7:37      O:044        O:044        I:022      I:026    I:042    I:036                     B3  |
|----] [--------] [--------] [--------] [-------] [------] [------] [--------------------------( )---|
|    15         04           05           11         02       00       15                      426  |
|[442]     [30]         [31]                                                                      |
B3/426 - ] [ - File #2 MAIN_PRGRM -  125,126,127,128,129,130,446
        -( )- - File #2 MAIN_PRGRM -  444
```

```
Rung #445
|                                                                     PUMP AREA          |
| PUMP AREA   BLOWER 2                                                2, 3, & 4          |
| 2 ENABLE    ENABLED                                                 RV TIMER           |
| PUMP2E      BL2                                                     P2-4RVTMR          |
|   N7:37       0:027                                                 +-TON-------------+ |
|---] [---+----] [--------------------------------------------------+-|TIMER ON DELAY  |-(EN)-|
| |  14   |     01                                                    |TIMER:      T4:3| |
| |[441]  |   [93]                                                    |BASE (SEC):  1.0|-(DN) |
| |       |                                                           |PRESET:        5| |
| |       |                                                           |ACCUM:         0| |
| |       |                                                           +----------------+ |
| |PUMP AREA |                                                                         |
| |3 ENABLE  |                                                                         |
| |PUMP3E    |                                                                         |
| |  N7:37   |                                                                         |
| |---] [----|                                                                         |
| |   15     |                                                                         |
| |[446]     |                                                                         |
| |PUMP AREA |                                                                         |
| |4 ENABLE  |                                                                         |
| |PUMP4E    |                                                                         |
| |  N7:38   |                                                                         |
| +---] [----+                                                                         |
|     0                                                                                |
| [447]
T4:3.DN - ] [ - File #2 MAIN_PRGRM - 56,57,58
Rung #446
|          DWELL 3     DWELL 4     BUFFER 3                                              |
|          CHAMBER     CHAMBER     CHAMBER                                               |
| PUMP 3   GATE VALVE  GATE VALVE  GATE VALVE                          PUMP AREA         |
| STAGE 1  OPEN        OPEN        OPEN                                3 ENABLE          |
| P3ST1    HV6S3       HV7S3       HV8S3                               PUMP3E            |
|   B3       I:024       I:036       I:040                              N7:37            |
|---] [-------] [---------] [---------] [---+---------------------------+--(U)----------+-|
| |  426      05          10          02    |                           |   15           | |
| |[444]                                    |                           |                | |
| |                                         | N7:37/15 - ] [ - File #2 MAIN_PRGRM - 30, 31,  |
| |                                         |     57, 73, 107, 420, 422, 443,        | |
| |                                         |     444, 445                |PUMP 3         | |
| |                                         |  ]/[ - File #2 MAIN_PRGRM - 369, 418   |END PULSE | |
| |                                         |  -(L)- - File #2 MAIN_PRGRM - 442      |P3ENDPULSE| |
| |ABORT PUMPDOWN                           | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2 +-TON--+ |
| |BT_PD                                    | T4:126.TT - ] [ - File #2 MAIN_PRGRM - 91  +-|TIMER ON DELAY |-(EN)-+
| |    N7:17                                |                           |TIMER:    T4:126|  |
| |----] [----------------------------------|                           |BASE (SEC):  1.0|-(DN) |
| |     8                                   |                           |PRESET:        5|  |
| |[3]                                      |                           |ACCUM:         0|  |
| |                                         |                           +----------------+  |
| |PIRINI                                   |                                              |
| |GUAGE 3                                  |                                              |
| |NO FAULT                                 |                                              |
| |PGNF3                                    |                                              |
| |  I:024                                  |                                              |
| |---]/[-----------------------------------|                                              |
| |  14                                     |                                              |
| |PREPARE FOR                              |                                              |
| |AUTO RUN                                 |                                              |
| |>AUTO                                    |                                              |
| |   N7:37                                 |                                              |
| +----] [----------------------------------+                                              |
|      1                                                                                 |
| [162]
```

```
Rung #447
|                  DWELL 5     DWELL 6     BUFFER 4                                         |
|         PIRINI    CHAMBER     CHAMBER     CHAMBER     SYSTEM                               |
|PUMP AREA GUAGE 4 GATE VALVE  GATE VALVE  GATE VALVE  VENT     VENT AREA          PUMP AREA |
|4       NO FAULT  CLOSED      CLOSED      CLOSED      ENABLE   4 ENABLE           4 ENABLE  |
|TS24    PGNF4     HV9S1       HV10S1      HV11S1      SYSVNTE  VENT4E             PUMP4E    |
|  N7:17   I:024     I:040       I:052       I:054      N7:37    N7:37              N7:38    |
|---] [-----] [-----] [-------] [--------] [--------]/[-----]/[--------------------(L)----|
|   0       15        03          06          00          5        9                  0     |
|[3]                                                   [369]    [429]                      |
N7:38/0 - ] [ - File #2 MAIN_PRGRM -  32,33,58,73,108,427,445,448,449
          ]/[ - File #2 MAIN_PRGRM -  369,425
          -(L)- - File #2 MAIN_PRGRM -  447
          -(U)- - File #2 MAIN_PRGRM -  450
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #448
|PUMP AREA                                                 PUMP SECTION 4     |
|4 ENABLE                                                  TIMER              |
|PUMP4E                                                    PMP4TMR            |
|  N7:38                                                   +-TON-----------+  |
|---] [----------------------------------------------------|TIMER ON DELAY |-(EN)-|
|   0                                                      |TIMER:   T4:295|  |
|[447]                                                     |BASE (SEC): 1.0|-(DN) |
|                                                          |PRESET:     600|  |
|                                                          |ACCUM:        0|  |
|                                                          +---------------+  |
T4:295.DN - ] [ - File #2 MAIN_PRGRM -  609
Rung #449
|                                                      DWELL 5                |
|          ENABLE      ENABLE      DWELL 5             CHAMBER                |
|          CRYO        CRYO        CHAMBER             ROUGH                  |
|PUMP AREA COMPRESSOR COMPRESSOR  VENT VALVE DOOR 8 DOOR 9 VALVE       PUMP 4 |
|4 ENABLE  7          8           CLOSED     CLOSED CLOSED CLOSED      STAGE 1|
|PUMP4E    CY7        CY8         CVS7       DRCL8S DRCL9S RVS7        P4ST1  |
|  N7:38    O:060      O:060       I:036      I:042  I:056  I:052       B3    |
|---] [-----] [-------] [---------] [--------] [----] [----] [----------( )---|
|   0        04         05          11         02     00     14         428   |
|[450]     [32]       [33]                                                    |
B3/428 - ] [ - File #2 MAIN_PRGRM -  131,132,133,134,135,136,450
       -( )- - File #2 MAIN_PRGRM -  449
```

```
Rung #450
          DWELL 5      DWELL 6      BUFFER 4
          CHAMBER      CHAMBER      CHAMBER
 PUMP 4   GATE VALVE   GATE VALVE   GATE VALVE                         PUMP AREA
 STAGE 1  OPEN         OPEN         OPEN                               4 ENABLE
 P4ST1    HV9S3        HV10S3       HV11S3                             PUMP4E
  B3       I:040        I:052        I:054                               N7:38
--] [--------] [---------] [----------] [------------------------------------(U)--
  428        05           10           02                                     0
 [449]
                         N7:38/0 - ] [ - - File #2 MAIN_PRGRM - 32, 33, 58,
                                         73, 108, 427, 445, 448, 449
                                   ]/[ - - File #2 MAIN_PRGRM - 369, 425      PUMP 4
                                   -(L)- - File #2 MAIN_PRGRM - 447           END PULSE
                          _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2          P4ENDPULSE
 ABORT PUMPDOWN           T4:127.TT - ] [ - - File #2 MAIN_PRGRM - 91          --TON--
 BT_PD                                                                        TIMER ON DELAY  -(EN)-
     N7:17                                                                    TIMER:   T4:127
-----] [---------------                                                       BASE (SEC): 1.0 -(DN)
       8                                                                      PRESET:      5
 [3]                                                                          ACCUM:       0

 PIRINI
 GUAGE 4
 NO FAULT
 PGNF4
  I:024
---]/[-----------------
   15
 PREPARE FOR
 AUTO RUN
 >AUTO
   N7:37
-----] [---------------
       1
 [162]
Rung #451
           EXITLOCK
           CHAMBER      SYSTEM
 PUMP AREA GATE VALVE   VENT      VENT AREA                               PUMP AREA
 5         CLOSED       ENABLE    5 ENABLE                                5 ENABLE
 TS25      HV12S1       SYSVNTE   VENT5E                                  PUMP5E
  N7:17     I:054       N7:37     N7:37                                     N7:38
---] [-------] [---------]/[-------]/[-------------------------------------(L)--
    1          03          5        10                                        1
 [3]                     [369]    [433]
N7:38/1 - ] [ - - File #2 MAIN_PRGRM -  32,78,109,327,335,340,353,452,453,456
          ]/[ - - File #2 MAIN_PRGRM -  369,414,430
          -(L)- - File #2 MAIN_PRGRM -  451
          -(U)- - File #2 MAIN_PRGRM -  454
 _F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #452
 PUMP AREA                                                        PUMP SECTION 5
 5 ENABLE                                                         TIMER
 PUMP5E                                                           PMP5TRM
   N7:38                                                          --TON--
----] [-----------------------------------------------------------TIMER ON DELAY  -(EN)-
     1                                                            TIMER:   T4:296
 [451]                                                            BASE (SEC): 1.0 -(DN)
                                                                  PRESET:    600
                                                                  ACCUM:       0
```

```
T4:296.DN - -| |- - File #2 MAIN_PRGRM   609
Rung #453
|            ENABLE      OPEN                                                    |
|            CRYO        EXLOCK                                                  |
|PUMP AREA   COMPRESSOR  CHAMBER     DOOR 10  DOOR 11  DOOR 12        PUMP 5     |
|5 ENABLE    7           VENT VALVE  CLOSED   OPEN     CLOSED         STAGE 1    |
|PUMP5E      CY7         CV5         DRCL10S  DROP11S  DRCL12S        P5ST1      |
|  N7:38       O:060       O:057      I:056    I:056    I:056          B3        |
|----] [------] [---------]/[--------] [------] [------] [--------------( )-------|
|     1        04          16         02       05       06             430       |
|[454]       [32]        [367]                                                   |
B3/430 - -| |- - File #2 MAIN_PRGRM - 137,138,454
         -( )- - File #2 MAIN_PRGRM - 453
Rung #454
|                                                        PUMP AREA               |
| ABORT PUMPDOWN                                         5 ENABLE                |
| BT_PD                                                  PUMP5E                  |
|      N7:17                                               N7:38                 |
|-+----] [-----+-----------------------------------------+----(U)-------------+-|
| |     8      |                                          |     1              | |
| |[3]         |                                          |                    | |
| |            | N7:38/1 - -| |- - File #2 MAIN_PRGRM - 32, 78, 109, 327, 335, 340,
| |            |                   353, 452, 453, 456     |                    | |
| |       EXIT |          -|/|- - File #2 MAIN_PRGRM - 369, 414, 430          | |
| |     BUFFER |          -(L)- - File #2 MAIN_PRGRM - 451 |PUMP 5             | |
| |PUMP 5  GATE VALVE | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2             | |
| |STAGE 1 OPEN       | T4:128.TT - -| |- - File #2 MAIN_PRGRM - 98, 326         | |
| |P5ST1   HV12S3     |                                   |END PULSE          | |
| |                   |                                   |P5ENDPULSE         | |
| |  B3      I:054    |                                   +--TON------------+ | |
| +--] [------] [-----+                                   +-|TIMER ON DELAY  |-(EN)-+ |
| |  430       05     |                                     |TIMER:   T4:128 |     |
| |[453]              |                                     |BASE (SEC): 1.0 |-(DN)|
| |                   |                                     |PRESET:       5 |     |
| |PREPARE FOR        |                                     |ACCUM:        0 |     |
| |AUTO RUN           |                                     +----------------+     |
| |>AUTO              |                                                            |
| |   N7:37           |                                                            |
| +----] [------------+                                                            |
|       1                                                                          |
| [162]                                                                            |
Rung #455
|PUMP AREA  BLOWER 1                                         PUMP AREA           |
|1 ENABLE   ENABLED                                          1 RV TIMER          |
|PUMP1E     BL1                                              P1RVTMR             |
|  N7:37      O:007                                          +--TON-----------+  |
|----] [-------] [-------------------------------------------|TIMER ON DELAY  |-(EN)-|
|     13        01                                           |TIMER:     T4:2 |  |
|[437]        [86]                                           |BASE (SEC): 1.0 |-(DN)|
|                                                            |PRESET:       5 |  |
|                                                            |ACCUM:        0 |  |
|                                                            +----------------+  |
T4:2.DN - -| |- - File #2 MAIN_PRGRM - 167
Rung #456
|PUMP AREA  BLOWER 3                                         PUMP AREA           |
|5 ENABLE   ENABLED                                          5 RV TIMER          |
|PUMP5E     BL3                                              T5RVTMR             |
|  N7:38      O:057                                          +--TON-----------+  |
|----] [-------] [-------------------------------------------|TIMER ON DELAY  |-(EN)-|
|     1         01                                           |TIMER:     T4:4 |  |
|[454]        [100]                                          |BASE (SEC): 1.0 |-(DN)|
|                                                            |PRESET:       5 |  |
|                                                            |ACCUM:        0 |  |
|                                                            +----------------+  |
```

```
T4:4.DN - ┤ ├ - File #2 MAIN_PRGRM    340
Rung #457
|MANUAL
|CONTROL
|CRYO GATE                                                       MANUAL CRYO
|1 OPEN                                                          GATE 1 OPEN
|M-HV1-1                                                         MCG1OP
|  N7:4                                                            N7:25
├──┤ ├──────────────────────────────────────────────────────────┬──(L)──┬─┤
|   5                                                            |   5   | |
|[3]                                                             |       | |
| N7:25/5 - ┤ ├ - File #2 MAIN_PRGRM - 115                       |       | |
|          -(U)- - File #2 MAIN_PRGRM - 458                      |MANUAL CRYO
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                    |GATE 1 CLOSE
| N7:26/12 - -(L)- - File #2 MAIN_PRGRM - 458                    |MCG1CL | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                    |  N7:26| |
|                                                                └──(U)──┘ |
|                                                                    12    |
Rung #458
|  MANUAL
|  CONTROL
|  CRYO GATE                                                     MANUAL CRYO
|  1 CLOSE                                                       GATE 1 OPEN
|  M-HV1-0                                                       MCG1OP
|    N7:5                                                          N7:25
├─┬───┤ ├───┬───────────────────────────────────────────────────┬──(U)──┬─┤
| |    12   |                                                   |   5   | |
| |[3]      |                                                   |       | |
| |         | N7:25/5 - ┤ ├ - File #2 MAIN_PRGRM - 115          |       | |
| |         |          -(L)- - File #2 MAIN_PRGRM - 457         |       | |
| |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       |MANUAL CRYO
| |         | N7:26/12 - -(U)- - File #2 MAIN_PRGRM - 457       |GATE 1 CLOSE
| |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2    |MCG1CL | |
| |AUTO RUN |                                                   |  N7:26| |
| |>AUTO    |                                                   └──(L)──┘ |
| |  N7:37  |                                                       12    |
| ├──┤ ├────┤                                                             |
| |    1    |                                                             |
| |[162]    |                                                             |
| |COMPRESSOR                                                             |
| |1 REGEN- |                                                             |
| |ERATION  |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN1   |                                                             |
| |   B3    |                                                             |
| └──┤ ├────┘                                                             |
|    321                                                                  |
|  [3:0]                                                                  |
```

Rung #459

```
|MANUAL                                                                                    |
|CONTROL                                                                                   |
|CRYO GATE                                                                MANUAL CRYO      |
|2 OPEN                                                                   GATE 2 OPEN      |
|M-HV2-1                                                                  MCG2OP           |
|   N7:4                                                                     N7:25         |
|---] [-------------------------------------------------------------------+----(L)----+----|
|    6                                                                    |     6     |    |
|[3]                                                                      |           |    |
| N7:25/6 - ] [ - File #2 MAIN_PRGRM - 117, 118, 462                      |           |    |
|           -(U)- - File #2 MAIN_PRGRM - 460                              |MANUAL CRYO|    |
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                             |GATE 2 CLOSE    |
| N7:26/13 - -(L)- - File #2 MAIN_PRGRM - 460                             |MCG2CL     |    |
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                             |    N7:26  |    |
|                                                                         +----(U)----+    |
                                                                                13
```

Rung #460

```
| MANUAL                                                                                   |
| CONTROL                                                                                  |
| CRYO GATE                                                               MANUAL CRYO      |
| 2 CLOSE                                                                 GATE 2 OPEN      |
| M-HV2-0                                                                 MCG2OP           |
|    N7:5                                                                    N7:25         |
|-+----] [---+------------------------------------------------------------+----(U)----+----|
| |     13   |                                                            |     6     |    |
| |[3]       |                                                            |           |    |
| |          | N7:25/6 - ] [ - File #2 MAIN_PRGRM - 117, 118, 462         |           |    |
| |          |          -(L)- - File #2 MAIN_PRGRM - 459                  |           |    |
| |MANUAL    | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                |MANUAL CRYO|    |
| |CONTROL   | N7:26/13 - -(U)- - File #2 MAIN_PRGRM - 459                |GATE 2 CLOSE    |
| |CRYO GATE | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                |MCG2CL     |    |
| |2 THROTTLE|                                                            |    N7:26  |    |
| |M-HV2-2   |                                                            +----(L)----+    |
| |   N7:5   |                                                                 13          |
| +---] [----+                                                                             |
| |    1     |                                                                             |
| |[3]       |                                                                             |
| |PREPARE FOR                                                                             |
| |AUTO RUN  |                                                                             |
| |>AUTO     |                                                                             |
| |   N7:37  |                                                                             |
| +---]/[----+                                                                             |
| |    1     |                                                                             |
| |[162]     |                                                                             |
| |COMPRESSOR|                                                                             |
| |2 REGEN-  |                                                                             |
| |ERATION   |                                                                             |
| |PROGRAM   |                                                                             |
| |CYRGN2    |                                                                             |
| |    B3    |                                                                             |
| +---] [----+                                                                             |
|    322                                                                                   |
|  [3:34]                                                                                  |
```

```
Rung #461
|MANUAL
|CONTROL
|CRYO GATE                                                              MANUAL CRYO
|2 THROTTLE                                                             GATE 2 THROTTLE
|M-HV2-2                                                                MCG2TL
|    N7:5                                                                    N7:26
|----] [----------------------------------------------------------------------(L)-----|
|     1                                                                        1
|[3]
N7:26/1 - ] [ - File #2 MAIN_PRGRM -  118,118
        -(L)- - File #2 MAIN_PRGRM -  461
        -(U)- - File #2 MAIN_PRGRM -  462
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #462
| MANUAL
| CONTROL
| CRYO GATE                                                             MANUAL CRYO
| 2 CLOSE                                                               GATE 2 THROTTLE
| M-HV2-0                                                               MCG2TL
|    N7:5                                                                    N7:26
|-+----] [----+---------------------------------------------------------------(U)-----|
| |     13    |                                                                1
| |[3]        |
| |           | N7:26/1 - ] [ - File #2 MAIN_PRGRM - 118
| |           |         -(L)- - File #2 MAIN_PRGRM - 461
| |           | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |MANUAL CRYO|
| |GATE 2 OPEN|
| |MCG2OP     |
| |   N7:25   |
| |----] [----|
| |     6     |
| |[460]      |
| |PREPARE FOR|
| |AUTO RUN   |
| |>AUTO      |
| |   N7:37   |
| |----] [----|
| |     1     |
| |[162]      |
| |COMPRESSOR |
| |2 REGEN-   |
| |ERATION    |
| |PROGRAM    |
| |CYRGN2     |
| |   B3      |
| +----] [----+
|     322
| [3:34]
```

```
Rung #463
|MANUAL                                                                                      |
|CONTROL                                                                                     |
|CRYO GATE                                                                   MANUAL CRYO     |
|3 OPEN                                                                      GATE 3 OPEN     |
|M-HV3-1                                                                     MCG3OP          |
|   N7:4                                                                        N7:25        |
|----] [------------------------------------------------------------------------+----(L)----+-|
|     7                                                                      |    7        | |
|[3]                                                                         |             | |
| N7:25/7 - ] [ - File #2 MAIN_PRGRM - 119, 120, 466                         |             | |
|          -(U)- - File #2 MAIN_PRGRM - 464                                  |MANUAL CRYO  | |
| _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                                |GATE 3 CLOSE | |
| N7:26/14 - -(L)- - File #2 MAIN_PRGRM - 464                                |MCG3CL       | |
| _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                                |    N7:26    | |
|                                                                            +----(U)------+ |
                                                                                  14         |
Rung #464
| MANUAL                                                                                     |
| CONTROL                                                                                    |
| CRYO GATE                                                                  MANUAL CRYO     |
| 3 CLOSE                                                                    GATE 3 OPEN     |
| M-HV3-0                                                                    MCG3OP          |
|    N7:5                                                                       N7:25        |
|-+---] [----+-----------------------------------------------------------------+----(U)----+-|
| |    14    |                                                              |    7        | |
| |[3]       |                                                              |             | |
| |          | N7:25/7 - ] [ - File #2 MAIN_PRGRM - 119, 120, 466           |             | |
| |          |          -(L)- - File #2 MAIN_PRGRM - 463                    |             | |
| |MANUAL    | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                  |MANUAL CRYO  | |
| |CONTROL   | N7:26/14 - -(U)- - File #2 MAIN_PRGRM - 463                  |GATE 3 CLOSE | |
| |CRYO GATE | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                  |MCG3CL       | |
| |3 THROTTLE|                                                              |    N7:26    | |
| |M-HV3-2   |                                                              +----(L)------+ |
| |   N7:5   |                                                                   14        |
| +---] [----+                                                                             |
| |    2     |                                                                             |
| |[3]       |                                                                             |
| |PREPARE FOR|                                                                            |
| |AUTO RUN  |                                                                             |
| |>AUTO     |                                                                             |
| |   N7:37  |                                                                             |
| +---] [----+                                                                             |
| |    1     |                                                                             |
| |[162]     |                                                                             |
| |COMPRESSOR|                                                                             |
| |3 REGEN-  |                                                                             |
| |ERATION   |                                                                             |
| |PROGRAM   |                                                                             |
| |CYRGN3    |                                                                             |
| |   B3     |                                                                             |
| +---] [----+                                                                             |
|     323                                                                                  |
|  [3:38]                                                                                  |
```

```
Rung #465
|MANUAL
|CONTROL                                                                          MANUAL CRYO |
|CRYO GATE                                                                        GATE 3      |
|3 THROTTLE                                                                       THROTTLE    |
|M-HV3-2                                                                          MCG3TL      |
|   N7:5                                                                             N7:26    |
|----| |---------------------------------------------------------------------------------(L)---|
|     2                                                                                 2     |
|[3]
N7:26/2 - -| |- - File #2 MAIN_PRGRM -  120,120
          -(L)- - File #2 MAIN_PRGRM -  465
          -(U)- - File #2 MAIN_PRGRM -  466
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #466
|  MANUAL
|  CONTROL                                                                        MANUAL CRYO |
|  CRYO GATE                                                                      GATE 3      |
|  3 CLOSE                                                                        THROTTLE    |
|  M-HV3-0                                                                        MCG3TL      |
|     N7:5                                                                           N7:26    |
|-+-----| |------+-------------------------------------------------------------------(U)-------|
| |      14      |                                                                    2       |
| |[3]           |                                                                            |
| |              | N7:26/2 - -| |- - File #2 MAIN_PRGRM - 120                                 |
| |              |           -(L)- - File #2 MAIN_PRGRM - 465                                 |
| |              | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                |
| |MANUAL CRYO   |                                                                            |
| |GATE 3 OPEN   |                                                                            |
| |MCG3OP        |                                                                            |
| |    N7:25     |                                                                            |
| |-----| |------|                                                                            |
| |      7       |                                                                            |
| |[464]         |                                                                            |
| |PREPARE FOR   |                                                                            |
| |AUTO RUN      |                                                                            |
| |>AUTO         |                                                                            |
| |    N7:37     |                                                                            |
| |-----| |------|                                                                            |
| |      1       |                                                                            |
| |[162]         |                                                                            |
| |COMPRESSOR    |                                                                            |
| |3 REGEN-      |                                                                            |
| |ERATION       |                                                                            |
| |PROGRAM       |                                                                            |
| |CYRGN3        |                                                                            |
| |     B3       |                                                                            |
| +-----| |------+                                                                            |
|      323                                                                                    |
|  [3:38]                                                                                     |
```

```
Rung #467
|MANUAL                                                                                    |
|CONTROL                                                                                   |
|CRYO GATE                                                                   MANUAL CRYO   |
|4 OPEN                                                                      GATE 4 OPEN   |
|M-HV4-1                                                                     MCG4OP        |
|   N7:4                                                                         N7:25     |
|---] [----------------------------------------------------------------+--------(L)-----+-|
|     8                                                                |          8     | |
|[3]                                                                   |                | |
| N7:25/8 - ] [ - File #2 MAIN_PRGRM - 121, 122, 470                   |                | |
|            -(U)- - File #2 MAIN_PRGRM - 468                          |MANUAL CRYO     | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                          |GATE 4 CLOSE    | |
| N7:26/15 - -(L)- - File #2 MAIN_PRGRM - 468                          |MCG4CL          | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                          |    N7:26       | |
|                                                                      +--------(U)-----+ |
|                                                                                15        |
Rung #468
| MANUAL                                                                                   |
| CONTROL                                                                                  |
| CRYO GATE                                                                  MANUAL CRYO   |
| 4 CLOSE                                                                    GATE 4 OPEN   |
| M-HV4-O                                                                    MCG4OP        |
|     N7:5                                                                       N7:25     |
|-+----] [----+--------------------------------------------------------+--------(U)-----+-|
| |     15    |                                                        |          8     | |
| |[3]        |                                                        |                | |
| |           | N7:25/8 - ] [ - File #2 MAIN_PRGRM - 121, 122, 470     |                | |
| |           |             -(L)- - File #2 MAIN_PRGRM - 467           |                | |
| |MANUAL     | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |MANUAL CRYO     | |
| |CONTROL    | N7:26/15 - -(U)- - File #2 MAIN_PRGRM - 467            |GATE 4 CLOSE    | |
| |CRYO GATE  | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |MCG4CL          | |
| |4 THROTTLE |                                                        |    N7:26       | |
| |M-HV4-2    |                                                        +--------(L)-----+ |
| |    N7:5   |                                                                 15        |
| +----] [----+                                                                           |
| |     3     |                                                                           |
| |[3]        |                                                                           |
| |PREPARE FOR|                                                                           |
| |AUTO RUN   |                                                                           |
| |>AUTO      |                                                                           |
| |    N7:37  |                                                                           |
| +----] [----+                                                                           |
| |     1     |                                                                           |
| |[162]      |                                                                           |
| |COMPRESSOR |                                                                           |
| |5 REGEN-   |                                                                           |
| |ERATION    |                                                                           |
| |PROGRAM    |                                                                           |
| |CYRGN5     |                                                                           |
| |     B3    |                                                                           |
| +----] [----+                                                                           |
|      325                                                                                 |
|  [3:46]                                                                                  |
```

Rung #469

```
|MANUAL                                                              |
|CONTROL                                              MANUAL CRYO    |
|CRYO GATE                                            GATE 4         |
|4 THROTTLE                                           THROTTLE       |
|M-HV4-2                                              MCG4TL         |
|   N7:5                                                  N7:26      |
|---] [------------------------------------------------------(L)-----|
|    3                                                        3      |
|[3]
N7:26/3 - ] [ - File #2 MAIN_PRGRM -  122,122
          -(L)- - File #2 MAIN_PRGRM -  469
          -(U)- - File #2 MAIN_PRGRM -  470
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #470

```
| MANUAL                                                             |
| CONTROL                                             MANUAL CRYO    |
| CRYO GATE                                           GATE 4         |
| 4 CLOSE                                             THROTTLE       |
| M-HV4-0                                             MCG4TL         |
|    N7:5                                                 N7:26      |
|-+----] [-----+-----------------------------------------(U)---------|
| |     15     |                                              3      |
| |[3]         |
| |            | N7:26/3 - ] [ - File #2 MAIN_PRGRM - 122
| |            |          -(L)- - File #2 MAIN_PRGRM - 469
| |            | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |MANUAL CRYO |
| |GATE 4 OPEN |
| |MCG4OP      |
| |   N7:25    |
| |----] [-----|
| |     8      |
| |[468]       |
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |   N7:37    |
| |----] [-----|
| |     1      |
| |[162]       |
| |COMPRESSOR  |
| |4 REGEN-    |
| |ERATION     |
| |PROGRAM     |
| |CYRGN4      |
| |    B3      |
| +----] [-----+
|     324
|  [3:42]
```

```
Rung #471
|MANUAL
|CONTROL
|CRYO GATE                                                          MANUAL CRYO
|5 OPEN                                                             GATE 5 OPEN
|M-HV5-1                                                            MCG5OP
|  N7:4                                                               N7:25
|---| |--------------------------------------------------------------+---(L)----+-
|   9                                                                |     9     |
|[3]                                                                 |           |
| N7:25/9 - -| |- - File #2 MAIN_PRGRM - 123, 124, 474                |           |
|           -(U)- - File #2 MAIN_PRGRM - 472                         |MANUAL CRYO|
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |GATE 5 CLOSE
| N7:27/0 - -(L)- - File #2 MAIN_PRGRM - 472                         |MCG5CL     |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |    N7:27  |
|                                                                    +---(U)----+
|                                                                          0
Rung #472
| MANUAL
| CONTROL
| CRYO GATE                                                         MANUAL CRYO
| 5 CLOSE                                                           GATE 5 OPEN
| M-HV5-0                                                           MCG5OP
|    N7:6                                                             N7:25
|-+---| |----+----------------------------------------------------+---(U)----+-
| |     0    |                                                    |     9     |
| |[3]       |                                                    |           |
| |          | N7:25/9 - -| |- - File #2 MAIN_PRGRM - 123, 124, 474 |           |
| |          |            -(L)- - File #2 MAIN_PRGRM - 471        |           |
| |MANUAL    | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2         |MANUAL CRYO|
| |CONTROL   | N7:27/0 - -(U)- - File #2 MAIN_PRGRM - 471         |GATE 5 CLOSE
| |CRYO GATE | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2         |MCG5CL     |
| |5 THROTTLE|                                                    |   N7:27   |
| |M-HV5-2   |                                                    +---(L)----+
| |   N7:5   |                                                          0
| +---| |----+
| |     4    |
| |[3]       |
| |PREPARE FOR
| |AUTO RUN  |
| |>AUTO     |
| |   N7:37  |
| +---| |----+
| |     1    |
| |[162]     |
| |COMPRESSOR|
| |4 REGEN-  |
| |ERATION   |
| |PROGRAM   |
| |CYRGN4    |
| |    B3    |
| +---| |----+
|     324
|  [3:42]
```

```
Rung #473
|MANUAL                                                                  MANUAL CRYO |
|CONTROL                                                                 GATE 5      |
|CRYO GATE                                                               THROTTLE    |
|5 THROTTLE                                                              MCG5TL      |
|M-HV5-2                                                                    N7:26    |
|    N7:5                                                                            |
|----] [------------------------------------------------------------------(L)-------|
|     4                                                                      4       |
|[3]
N7:26/4 - ] [ - File #2 MAIN_PRGRM -  124,124
          -(L)- - File #2 MAIN_PRGRM -  473
          -(U)- - File #2 MAIN_PRGRM -  474
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #474
| MANUAL                                                                 MANUAL CRYO |
| CONTROL                                                                GATE 5      |
| CRYO GATE                                                              THROTTLE    |
| 5 CLOSE                                                                MCG5TL      |
| M-HV5-0                                                                   N7:26    |
|   N7:6                                                                             |
|-+----] [------+---------------------------------------------------------(U)-------|
| |     0       |                                                            4       |
| |[3]          |                                                                    |
| |             | N7:26/4 - ] [ - File #2 MAIN_PRGRM - 124                           |
| |             |           -(L)- - File #2 MAIN_PRGRM - 473                         |
| |             | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                          |
| |MANUAL CRYO  |                                                                    |
| |GATE 5 OPEN  |                                                                    |
| |MCG5OP       |                                                                    |
| |    N7:25    |                                                                    |
| |----] [------|                                                                    |
| |      9      |                                                                    |
| |[472]        |                                                                    |
| |PREPARE FOR  |                                                                    |
| |AUTO RUN     |                                                                    |
| |>AUTO        |                                                                    |
| |    N7:37    |                                                                    |
| |----] [------|                                                                    |
| |      1      |                                                                    |
| |[162]        |                                                                    |
| |COMPRESSOR   |                                                                    |
| |4 REGEN-     |                                                                    |
| |ERATION      |                                                                    |
| |PROGRAM      |                                                                    |
| |CYRGN4       |                                                                    |
| |     B3      |                                                                    |
| +----] [------+                                                                    |
|      324                                                                           |
|  [3:42]                                                                            |
```

```
Rung #475
|MANUAL                                                                                  |
|CONTROL                                                                                 |
|CRYO GATE                                                             MANUAL CRYO       |
|6 OPEN                                                                GATE 6 OPEN       |
|M-HV6-1                                                               MCG6OP            |
|   N7:4                                                                   N7:25         |
|---] [----------------------------------------------------------------+----(L)-------+--|
|     10                                                               |     10        |  |
|[3]                                                                   |               |  |
| N7:25/10 - ] [ - File #2 MAIN_PRGRM - 125, 126, 478                  |               |  |
|            -(U)- - File #2 MAIN_PRGRM - 476                          |MANUAL CRYO    |  |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                          |GATE 6 CLOSE   |  |
| N7:27/1 - -(L)- - File #2 MAIN_PRGRM - 476                           |MCG6CL         |  |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                          |   N7:27       |  |
|                                                                      +----(U)-------+  |
|                                                                            1            |
Rung #476
| MANUAL                                                                                 |
| CONTROL                                                                                |
| CRYO GATE                                                            MANUAL CRYO       |
| 6 CLOSE                                                              GATE 6 OPEN       |
| M-HV6-0                                                              MCG6OP            |
|    N7:6                                                                  N7:25         |
|--+-----] [----+------------------------------------------------------+----(U)-------+--|
|  |      1     |                                                      |     10        |  |
|  |[3]         |                                                      |               |  |
|  |            | N7:25/10 - ] [ - File #2 MAIN_PRGRM - 125, 126, 478  |               |  |
|  |            |             -(L)- - File #2 MAIN_PRGRM - 475         |               |  |
|  |MANUAL      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |MANUAL CRYO    |  |
|  |CONTROL     | N7:27/1 - -(U)- - File #2 MAIN_PRGRM - 475           |GATE 6 CLOSE   |  |
|  |CRYO GATE   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |MCG6CL         |  |
|  |6 THROTTLE  |                                                      |   N7:27       |  |
|  |M-HV6-2     |                                                      +----(L)-------+  |
|  |   N7:5     |                                                            1           |
|  |----] [-----|                                                                        |
|  |  .  5      |                                                                        |
|  |[3]         |                                                                        |
|  |PREPARE FOR |                                                                        |
|  |AUTO RUN    |                                                                        |
|  |>AUTO       |                                                                        |
|  |   N7:37    |                                                                        |
|  |----] [-----|                                                                        |
|  |      1     |                                                                        |
|  |[162]       |                                                                        |
|  |COMPRESSOR  |                                                                        |
|  |5 REGEN-    |                                                                        |
|  |ERATION     |                                                                        |
|  |PROGRAM     |                                                                        |
|  |CYRGN5      |                                                                        |
|  |    B3      |                                                                        |
|  +----] [-----+                                                                        |
|       325                                                                               |
|  [3:46]                                                                                |
```

Rung #477

```
|MANUAL
|CONTROL                                                              MANUAL CRYO |
|CRYO GATE                                                            GATE 6      |
|6 THROTTLE                                                           THROTTLE    |
|M-HV6-2                                                              MCG6TL      |
|    N7:5                                                                N7:26    |
|----] [-------------------------------------------------------------------(L)-----|
|    5                                                                    5       |
|[3]
N7:26/5 - ] [ - File #2 MAIN_PRGRM -  126,126
        -(L)- - File #2 MAIN_PRGRM -  477
        -(U)- - File #2 MAIN_PRGRM -  478
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #478

```
| MANUAL
| CONTROL                                                             MANUAL CRYO |
| CRYO GATE                                                           GATE 6      |
| 6 CLOSE                                                             THROTTLE    |
| M-HV6-0                                                             MCG6TL      |
|    N7:6                                                                N7:26    |
|-+---] [---+--------------------------------------------------------------(U)-----|
| |    1    |                                                             5       |
| |[3]      |                                                                     |
| |         | N7:26/5 - ] [ - File #2 MAIN_PRGRM - 126                            |
| |         |         -(L)- - File #2 MAIN_PRGRM - 477                            |
| |         | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                         |
| |MANUAL CRYO|                                                                   |
| |GATE 6 OPEN|                                                                   |
| |MCG6OP   |                                                                     |
| |   N7:25 |                                                                     |
| |---] [---|                                                                     |
| |    10   |                                                                     |
| |[476]    |                                                                     |
| |PREPARE FOR|                                                                   |
| |AUTO RUN |                                                                     |
| |>AUTO    |                                                                     |
| |   N7:37 |                                                                     |
| |---] [---|                                                                     |
| |    1    |                                                                     |
| |[162]    |                                                                     |
| |COMPRESSOR|                                                                    |
| |5 REGEN- |                                                                     |
| |ERATION  |                                                                     |
| |PROGRAM  |                                                                     |
| |CYRGN5   |                                                                     |
| |    B3   |                                                                     |
| +---] [---+                                                                     |
|     325                                                                         |
|  [3:46]                                                                         |
```

```
Rung #479
|MANUAL
|CONTROL
|CRYO GATE                                                        MANUAL CRYO
|7 OPEN                                                           GATE 7 OPEN
|M-HV7-1                                                          MCG7OP
|   N7:4                                                             N7:25
|---| |--------------------------------------------------------------(L)------
|    11                                                               11
|[3]
| N7:25/11 - -| |- - File #2 MAIN_PRGRM - 127, 128, 482
|            -(U)- - File #2 MAIN_PRGRM - 480                    MANUAL CRYO
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                    GATE 7 CLOSE
| N7:27/2 - -(L)- - File #2 MAIN_PRGRM - 480                     MCG7CL
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        N7:27
|                                                                 ----(U)----
|                                                                      2
Rung #480
| MANUAL
| CONTROL
| CRYO GATE                                                       MANUAL CRYO
| 7 CLOSE                                                         GATE 7 OPEN
| M-HV7-0                                                         MCG7OP
|    N7:6                                                            N7:25
|----| |-------------------------------------------------------------(U)------
| |    2      |                                                       11
| |[3]        |
| |           | N7:25/11 - -| |- - File #2 MAIN_PRGRM - 127, 128, 482
| |           |              -(L)- - File #2 MAIN_PRGRM - 479
| |MANUAL     | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      MANUAL CRYO
| |CONTROL    | N7:27/2 - -(U)- - File #2 MAIN_PRGRM - 479       GATE 7 CLOSE
| |CRYO GATE  | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      MCG7CL
| |7 THROTTLE |                                                      N7:27
| |M-HV7-2    |                                                 ----(L)----
| |   N7:5    |                                                      2
| |---| |-----|
| |    6      |
| |[3]        |
| |PREPARE FOR|
| |AUTO RUN   |
| |>AUTO      |
| |   N7:37   |
| |---| |-----|
| |    1      |
| |[162]      |
| |COMPRESSOR |
| |5 REGEN-   |
| |ERATION    |
| |PROGRAM    |
| |CYRGN5     |
| |    B3     |
| |---| |-----|
|     325
|  [3:46]
```

```
Rung #481
|MANUAL                                                                                  |
|CONTROL                                                                   MANUAL CRYO   |
|CRYO GATE                                                                 GATE 7        |
|7 THROTTLE                                                                THROTTLE      |
|M-HV7-2                                                                   MCG7TL        |
|   N7:5                                                                      N7:26      |
|---] [-------------------------------------------------------------------------(L)------|
|    6                                                                           6       |
|[3]                                                                                     |
N7:26/6 - ] [ - File #2 MAIN_PRGRM -  128,128
         -(L)- - File #2 MAIN_PRGRM -  481
         -(U)- - File #2 MAIN_PRGRM -  482
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
Rung #482
|  MANUAL                                                                                |
|  CONTROL                                                                 MANUAL CRYO   |
|  CRYO GATE                                                               GATE 7        |
|  7 CLOSE                                                                 THROTTLE      |
|  M-HV7-0                                                                 MCG7TL        |
|    N7:6                                                                     N7:26      |
|-+---] [---+-------------------------------------------------------------------(U)------|
| |    2    |                                                                    6       |
| |[3]      |                                                                            |
| |         | N7:26/6 - ] [ - File #2 MAIN_PRGRM - 128                                   |
| |         |          -(L)- - File #2 MAIN_PRGRM - 481                                  |
| |         | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |
| |MANUAL CRYO |                                                                         |
| |GATE 7 OPEN |                                                                         |
| |MCG7OP   |                                                                            |
| |   N7:25 |                                                                            |
| +---] [---+                                                                            |
| |   11    |                                                                            |
| |[480]    |                                                                            |
| |PREPARE FOR                                                                           |
| |AUTO RUN |                                                                            |
| |>AUTO    |                                                                            |
| |   N7:37 |                                                                            |
| +---] [---+                                                                            |
| |    1    |                                                                            |
| |[162]    |                                                                            |
| |COMPRESSOR                                                                            |
| |5 REGEN- |                                                                            |
| |ERATION  |                                                                            |
| |PROGRAM  |                                                                            |
| |CYRGN5   |                                                                            |
| |    B3   |                                                                            |
| +---] [---+                                                                            |
|     325                                                                                |
|  [3:46]                                                                                |
```

```
Rung #483
|MANUAL
|CONTROL
|CRYO GATE                                                      MANUAL CRYO
|8 OPEN                                                         GATE 8 OPEN
|M-HV8-1                                                        MCG8OP
|  N7:4                                                           N7:25
|---| |--------------------------------------------------------+----(L)----+
|   12                                                         |     12     |
|[3]                                                           |            |
| N7:25/12 - -| |- - File #2 MAIN_PRGRM - 129, 130, 486         |            |
|            -(U)- - File #2 MAIN_PRGRM - 484                  |MANUAL CRYO |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |GATE 8 CLOSE|
| N7:27/3 - -(L)- - File #2 MAIN_PRGRM - 484                   |MCG8CL      |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |   N7:27    |
|                                                              +----(U)----+
                                                                     3
Rung #484
| MANUAL
| CONTROL
| CRYO GATE                                                     MANUAL CRYO
| 8 CLOSE                                                       GATE 8 OPEN
| M-HV8-0                                                       MCG8OP
|    N7:6                                                          N7:25
|-+---| |-------+-----------------------------------------------+----(U)----+
| |     3       |                                               |     12     |
| |[3]          |                                               |            |
| |             | N7:25/12 - -| |- - File #2 MAIN_PRGRM - 129, 130, 486      |
| |             |           -(L)- - File #2 MAIN_PRGRM - 483    |            |
| |MANUAL       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2   |MANUAL CRYO |
| |CONTROL      | N7:27/3 - -(U)- - File #2 MAIN_PRGRM - 483    |GATE 8 CLOSE|
| |CRYO GATE    | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2   |MCG8CL      |
| |8 THROTTLE   |                                               |   N7:27    |
| |M-HV8-2      |                                               +----(L)----+
| |   N7:5      |                                                      3
| +---| |-------+
| |   7         |
| |[3]          |
| |PREPARE FOR  |
| |AUTO RUN     |
| |>AUTO        |
| |   N7:37     |
| +---| |-------+
| |   1         |
| |[162]        |
| |COMPRESSOR   |
| |6 REGEN-     |
| |ERATION      |
| |PROGRAM      |
| |CYRGN6       |
| |   B3        |
| +---| |-------+
|     326
|  [3:52]
```

```
Rung #485
|MANUAL
|CONTROL                                                                          MANUAL CRYO |
|CRYO GATE                                                                        GATE 8      |
|8 THROTTLE                                                                       THROTTLE    |
|M-HV8-2                                                                          MCG8TL      |
|    N7:5                                                                            N7:26    |
|----| |-----------------------------------------------------------------------------(L)------|
|    7                                                                                 7      |
|[3]
N7:26/7 - -| |- - File #2 MAIN_PRGRM -  130,130
          -(L)- - File #2 MAIN_PRGRM -  485
          -(U)- - File #2 MAIN_PRGRM -  486
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #486
|  MANUAL
|  CONTROL                                                                        MANUAL CRYO |
|  CRYO GATE                                                                      GATE 8      |
|  8 CLOSE                                                                        THROTTLE    |
|  M-HV8-0                                                                        MCG8TL      |
|     N7:6                                                                           N7:26    |
|-+-----| |-----+-----------------------------------------------------------------(U)--------|
| |       3     |                                                                      7      |
| |[3]          |                                                                             |
| |             | N7:26/7 - -| |- - File #2 MAIN_PRGRM - 130                                  |
| |             |          -(L)- - File #2 MAIN_PRGRM - 485                                  |
| |             | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                  |
| |MANUAL CRYO  |                                                                             |
| |GATE 8 OPEN  |                                                                             |
| |MCG8OP       |                                                                             |
| |      N7:25  |                                                                             |
| |------| |----|                                                                             |
| |        12   |                                                                             |
| |[484]        |                                                                             |
| |PREPARE FOR  |                                                                             |
| |AUTO RUN     |                                                                             |
| |>AUTO        |                                                                             |
| |      N7:37  |                                                                             |
| |------| |----|                                                                             |
| |       1     |                                                                             |
| |[162]        |                                                                             |
| |COMPRESSOR   |                                                                             |
| |6 REGEN-     |                                                                             |
| |ERATION      |                                                                             |
| |PROGRAM      |                                                                             |
| |CYRGN6       |                                                                             |
| |      B3     |                                                                             |
| +------| |----+                                                                             |
|        326                                                                                  |
|   [3:52]                                                                                    |
```

```
Rung #487
|MANUAL
|CONTROL
|CRYO GATE                                                  MANUAL CRYO
|9 OPEN                                                     GATE 9 OPEN
|M-HV9-1                                                    MCG9OP
|   N7:4                                                       N7:25
|---] [-----------------------------------------------------------(L)---
|   13                                                            13
|[3]
| N7:25/13 - ] [ - File #2 MAIN_PRGRM - 131, 132, 490
|            -(U)- - File #2 MAIN_PRGRM - 488                MANUAL CRYO
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                GATE 9 CLOSE
| N7:27/4 - -(L)- - File #2 MAIN_PRGRM - 488                 MCG9CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   N7:27
|                                                          ------(U)----
|                                                                 4
Rung #488
| MANUAL
| CONTROL
| CRYO GATE                                                 MANUAL CRYO
| 9 CLOSE                                                   GATE 9 OPEN
| M-HV9-0                                                   MCG9OP
|     N7:6                                                     N7:25
|----] [-------------------------------------------------------(U)------
| |    4       |                                                  13
| |[3]         |
| |            | N7:25/13 - ] [ - File #2 MAIN_PRGRM - 131, 132, 490
| |            |            -(L)- - File #2 MAIN_PRGRM - 487
| |MANUAL      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  MANUAL CRYO
| |CONTROL     | N7:27/4 - -(U)- - File #2 MAIN_PRGRM - 487   GATE 9 CLOSE
| |CRYO GATE   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  MCG9CL
| |9 THROTTLE  |                                                 N7:27
| |M-HV9-2     |                                            ------(L)----
| |    N7:5    |                                                   4
| |----] [-----|
| |     8      |
| |[3]         |
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |    N7:37   |
| |----] [-----|
| |     1      |
| |[162]       |
| |COMPRESSOR  |
| |7 REGEN-    |
| |ERATION     |
| |PROGRAM     |
| |CYRGN7      |
| |     B3     |
| |----] [-----|
|     327
|  [3:57]
```

```
Rung #489
|MANUAL                                                     MANUAL CRYO |
|CONTROL                                                    GATE 9      |
|CRYO GATE                                                  THROTTLE    |
|9 THROTTLE                                                 MCG9TL      |
|M-HV9-2                                                       N7:26    |
|    N7:5                                                               |
|----] [-------------------------------------------------------(L)------|
|     8                                                          8      |
|[3]
N7:26/8 - ] [ - File #2 MAIN_PRGRM -  132,132
         -(L)- - File #2 MAIN_PRGRM -  489
         -(U)- - File #2 MAIN_PRGRM -  490
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #490
| MANUAL                                                    MANUAL CRYO |
| CONTROL                                                   GATE 9      |
| CRYO GATE                                                 THROTTLE    |
| 9 CLOSE                                                   MCG9TL      |
| M-HV9-0                                                      N7:26    |
|    N7:6                                                               |
|-+----] [-----+-----------------------------------------------(U)------|
| |      4     |                                                 8      |
| |[3]         |                                                        |
| |            | N7:26/8 - ] [ - File #2 MAIN_PRGRM - 132               |
| |            |          -(L)- - File #2 MAIN_PRGRM - 489              |
| |            | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2            |
| |MANUAL CRYO |                                                        |
| |GATE 9 OPEN |                                                        |
| |MCG9OP      |                                                        |
| |   N7:25    |                                                        |
| |----] [-----|                                                        |
| |      13    |                                                        |
| |[488]       |                                                        |
| |PREPARE FOR |                                                        |
| |AUTO RUN    |                                                        |
| |>AUTO       |                                                        |
| |   N7:37    |                                                        |
| |----] [-----|                                                        |
| |      1     |                                                        |
| |[162]       |                                                        |
| |COMPRESSOR  |                                                        |
| |7 REGEN-    |                                                        |
| |ERATION     |                                                        |
| |PROGRAM     |                                                        |
| |CYRGN7      |                                                        |
| |     B3     |                                                        |
| +----] [-----+                                                        |
|      327                                                              |
| [3:57]                                                                |
```

```
Rung #582
|MOTOR 15                                                          MOTOR 15
|REVERSE                                                           REVERSE
|ENABLE                                                            M15R
|M15RE                                                               B3
|  N7:19
|---| |-------------------------------------------------------------+--(L)--+-
|    14                                                             |  115  |
|[3]                                                                |       |
|                                                                   |MANUAL |
| B3/115 - -| |- - File #2 MAIN_PRGRM - 297                          |MOTOR 15
|          -|/|- - File #2 MAIN_PRGRM - 295                         |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 601                         |ENABLE |
| N7:40/14 - -(U)- - File #2 MAIN_PRGRM - 601                       |MM15RE |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       | N7:40 |
| N7:35/11 - -(L)- - File #2 MAIN_PRGRM - 601                       +--(L)--+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |  14   |
|                                                                   |MANUAL |
|                                                                   |MOTOR 15
|                                                                   |REVERSE|
|                                                                   |DISABLE|
|                                                                   |MM15RD |
|                                                                   | N7:35 |
|                                                                   +--(U)--+
|                                                                      11
Rung #583
|MOTOR 16
|REVERSE                                                           MOTOR 16
|ENABLE                                                            REVERSE
|M16RE                                                             M16R
|  N7:19                                                             B3
|---| |-------------------------------------------------------------+--(L)--+-
|    15                                                             |  116  |
|[3]                                                                |       |
|                                                                   |MANUAL |
| B3/116 - -| |- - File #2 MAIN_PRGRM - 306                          |MOTOR 16
|          -|/|- - File #2 MAIN_PRGRM - 306                         |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 602                         |ENABLE |
| N7:40/15 - -(U)- - File #2 MAIN_PRGRM - 602                       |MM16RE |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       | N7:40 |
| N7:35/12 - -(L)- - File #2 MAIN_PRGRM - 602                       +--(L)--+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |  15   |
|                                                                   |MANUAL |
|                                                                   |MOTOR 16
|                                                                   |REVERSE|
|                                                                   |DISABLE|
|                                                                   |MM16RD |
|                                                                   | N7:35 |
|                                                                   +--(U)--+
|                                                                      12
```

```
Rung #584
|MOTOR 17                                                                MOTOR 17
|REVERSE                                                                 REVERSE
|ENABLE                                                                  M17R
|M17RE                                                                     B3
|  N7:20                                                                 --(L)--
|--| |------------------------------------------------------------------| 117
|   0                                                                    |
|[3]                                                                     |MANUAL
|                                                                        |MOTOR 17
| B3/117 - -| |- - File #2 MAIN_PRGRM - 312                              |REVERSE
|          -|/|- - File #2 MAIN_PRGRM - 310                              |ENABLE
|          -(U)- - File #2 MAIN_PRGRM - 603                              |MM17RE
| N7:41/0 - -(U)- - File #2 MAIN_PRGRM - 603                             |  N7:41
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                            |--(L)--
| N7:35/13 - -(L)- - File #2 MAIN_PRGRM - 603                            |   0
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                            |MANUAL
|                                                                        |MOTOR 17
|                                                                        |REVERSE
|                                                                        |DISABLE
|                                                                        |MM17RD
|                                                                        |  N7:35
|                                                                        ---(U)--
|                                                                           13
```

```
Rung #585
|MOTOR 18                                                                MOTOR 18
|REVERSE                                                                 REVERSE
|ENABLE                                                                  M18R
|M18RE                                                                     B3
|  N7:20                                                                 --(L)--
|--| |------------------------------------------------------------------| 118
|   1                                                                    |
|[3]                                                                     |MANUAL
|                                                                        |MOTOR 18
| B3/118 - -| |- - File #2 MAIN_PRGRM - 317                              |REVERSE
|          -|/|- - File #2 MAIN_PRGRM - 315                              |ENABLE
|          -(U)- - File #2 MAIN_PRGRM - 604                              |MM18RE
| N7:41/1 - -(U)- - File #2 MAIN_PRGRM - 604                             |  N7:41
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                            |--(L)--
| N7:35/14 - -(L)- - File #2 MAIN_PRGRM - 604                            |   1
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                            |MANUAL
|                                                                        |MOTOR 18
|                                                                        |REVERSE
|                                                                        |DISABLE
|                                                                        |MM18RD
|                                                                        |  N7:35
|                                                                        ---(U)--
|                                                                           14
```

```
Rung #586
|MOTOR 19
|REVERSE                                                         MOTOR 19
|ENABLE                                                          REVERSE
|M19RE                                                           M19R
| N7:20                                                             B3
|--| |------------------------------------------------------------+--(L)--+-
|  2                                                              |  119  |
|[3]                                                              |       |
|                                                                 |MANUAL |
| B3/119 - -| |- - File #2 MAIN_PRGRM - 322                        |MOTOR 19
|          -|/|- - File #2 MAIN_PRGRM - 320                        |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 605                        |ENABLE |
| N7:41/2 - -(U)- - File #2 MAIN_PRGRM - 605                       |MM19RE |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      | N7:41 |
| N7:35/15 - -(L)- - File #2 MAIN_PRGRM - 605                      +--(L)--+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |   2   |
|                                                                 |MANUAL |
|                                                                 |MOTOR 19
|                                                                 |REVERSE|
|                                                                 |DISABLE|
|                                                                 |MM19RD |
|                                                                 | N7:35 |
|                                                                 +--(U)--+
|                                                                     15
Rung #587
|MOTOR 20
|REVERSE                                                         MOTOR 20
|ENABLE                                                          REVERSE
|M20RE                                                           M20R
| N7:20                                                             B3
|--| |------------------------------------------------------------+--(L)--+-
|  3                                                              |  120  |
|[3]                                                              |       |
|                                                                 |MANUAL |
| B3/120 - -| |- - File #2 MAIN_PRGRM - 333                        |MOTOR 20
|          -|/|- - File #2 MAIN_PRGRM - 331                        |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 606                        |ENABLE |
| N7:41/3 - -(U)- - File #2 MAIN_PRGRM - 606                       |MM20RE |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      | N7:41 |
| N7:36/0 - -(L)- - File #2 MAIN_PRGRM - 606                       +--(L)--+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |   3   |
|                                                                 |MANUAL |
|                                                                 |MOTOR 20
|                                                                 |REVERSE|
|                                                                 |DISABLE|
|                                                                 |MM20RD |
|                                                                 | N7:36 |
|                                                                 +--(U)--+
|                                                                     0
```

Rung #588

```
|MOTOR 21                                                      MOTOR 21
|REVERSE                                                       REVERSE
|ENABLE                                                        M21R
|M21RE                                                           B3
| N7:20
|---| |--------------------------------------------------------+--(L)--+
|   4                                                          |  121  |
|[3]                                                           |       |
|                                                              |MANUAL |
| B3/121 - -| |- - File #2 MAIN_PRGRM - 357                     |MOTOR 21
|          -|/|- - File #2 MAIN_PRGRM - 355                     |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 607                     |ENABLE |
| N7:41/4 - -(U)- - File #2 MAIN_PRGRM - 607                    |MM21_RE|
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   | N7:41 |
| N7:36/1 - -(L)- - File #2 MAIN_PRGRM - 607                    +--(L)--+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |   4   |
|                                                              |MANUAL |
|                                                              |MOTOR 21
|                                                              |REVERSE|
|                                                              |DISABLE|
|                                                              |MM21RD |
|                                                              | N7:36 |
|                                                              +--(U)--+
|                                                                  1
```

Rung #589

```
| MOTOR 3                                                       MOTOR 3
| REVERSE                                                       REVERSE
| DISABLE                                                       M3R
| M3RD                                                            B3
|   N7:13
|-+---| |-----+------------------------------------------------+--(U)--+
| |    15     |                                                |  103  |
| |[3]        |                                                |       |
| |           | B3/103 - -| |- - File #2 MAIN_PRGRM - 187       |MANUAL |
| |           |          -|/|- - File #2 MAIN_PRGRM - 185       |MOTOR 3|
| |           |          -(L)- - File #2 MAIN_PRGRM - 570       |REVERSE|
| |           | N7:40/2 - -(L)- - File #2 MAIN_PRGRM - 570      |ENABLE |
| |PREPARE FOR| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2     |MM3RE  |
| |AUTO RUN   | N7:34/15 - -(U)- - File #2 MAIN_PRGRM - 570     | N7:40 |
| |>AUTO      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2     +--(U)--+
| |   N7:37   |                                                |   2   |
| +---| |-----+                                                |       |
|      1                                                       |MANUAL |
| [162]                                                        |MOTOR 3|
|                                                              |REVERSE|
|                                                              |DISABLE|
|                                                              |MM3RD  |
|                                                              | N7:34 |
|                                                              +--(L)--+
|                                                                  15
```

Rung #590

```
| MOTOR 4                                                              MOTOR 4
| REVERSE                                                              REVERSE
| DISABLE                                                              M4R
| M4RD                                                                   B3
|   N7:14
|----| |----------------------------------------------------------------(U)----
|  |  0     |                                                          | 104
|  | [3]    |
|  |        | B3/104 - -| |- - File #2 MAIN_PRGRM - 192                |MANUAL
|  |        |          -|/|- - File #2 MAIN_PRGRM - 190                |MOTOR 4
|  |        |          -(L)- - File #2 MAIN_PRGRM - 571                |REVERSE
|  |        | N7:40/3 - -(L)- - File #2 MAIN_PRGRM - 571               |ENABLE
|  |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |MM4RE
|  |AUTO RUN    | N7:35/0 - -(U)- - File #2 MAIN_PRGRM - 571           |  N7:40
|  |>AUTO       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |---(U)---
|  |  N7:37     |                                                      |   3
|  |----| |-----|
|        1                                                             |MANUAL
|  [162]                                                               |MOTOR 4
|                                                                      |REVERSE
|                                                                      |DISABLE
|                                                                      |MM4RD
|                                                                      |  N7:35
|                                                                      |---(L)---
|                                                                          0
```

Rung #591

```
| MOTOR 5
| REVERSE                                                              MOTOR 5
| DISABLE                                                              REVERSE
| M5RD                                                                 M5R
|   N7:14                                                                B3
|----| |----------------------------------------------------------------(U)----
|  |  1     |                                                          | 105
|  | [3]    |
|  |        | B3/105 - -| |- - File #2 MAIN_PRGRM - 197                |MANUAL
|  |        |          -|/|- - File #2 MAIN_PRGRM - 195                |MOTOR 5
|  |        |          -(L)- - File #2 MAIN_PRGRM - 572                |REVERSE
|  |        | N7:40/4 - -(L)- - File #2 MAIN_PRGRM - 572               |ENABLE
|  |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |MM5RE
|  |AUTO RUN    | N7:35/1 - -(U)- - File #2 MAIN_PRGRM - 572           |  N7:40
|  |>AUTO       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |---(U)---
|  |  N7:37     |                                                      |   4
|  |----| |-----|
|        1                                                             |MANUAL
|  [162]                                                               |MOTOR 5
|                                                                      |REVERSE
|                                                                      |DISABLE
|                                                                      |MM5RD
|                                                                      |  N7:35
|                                                                      |---(L)---
|                                                                          1
```

Rung #592

```
| MOTOR 6                                                                         |
| REVERSE                                                             MOTOR 6     |
| DISABLE                                                             REVERSE     |
| M6RD                                                                M6R         |
|  N7:14                                                                B3        |
|----] [-------------------------------------------------------------+---(U)---+-|
| |   2   |                                                          |   106   | |
| |[3]    |                                                          |         | |
| |       | B3/106 - -] [- - File #2 MAIN_PRGRM - 220                |MANUAL   | |
| |       |          -]/[- - File #2 MAIN_PRGRM - 218                |MOTOR 6  | |
| |       |          -(L)- - File #2 MAIN_PRGRM - 573                |REVERSE  | |
| |       | N7:40/5 - -(L)- - File #2 MAIN_PRGRM - 573               |ENABLE   | |
| |PREPARE FOR | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          |MM6RE    | |
| |AUTO RUN    | N7:35/2 - -(U)- - File #2 MAIN_PRGRM - 573           |  N7:40  | |
| |>AUTO       | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          +---(U)---+ |
| |   N7:37    |                                                     |    5    | |
| +-----] [----+                                                     |         | |
|         1                                                          |MANUAL   | |
|  [162]                                                             |MOTOR 6  | |
|                                                                    |REVERSE  | |
|                                                                    |DISABLE  | |
|                                                                    |MM6RD    | |
|                                                                    |  N7:35  | |
|                                                                    +---(L)---+ |
|                                                                         2       |
```

Rung #593

```
| MOTOR 7                                                                         |
| REVERSE                                                             MOTOR 7     |
| DISABLE                                                             REVERSE     |
| M7RD                                                                M7R         |
|  N7:14                                                                B3        |
|----] [-------------------------------------------------------------+---(U)---+-|
| |   3   |                                                          |   107   | |
| |[3]    |                                                          |         | |
| |       | B3/107 - -] [- - File #2 MAIN_PRGRM - 233                |MANUAL   | |
| |       |          -]/[- - File #2 MAIN_PRGRM - 231                |MOTOR 7  | |
| |       |          -(L)- - File #2 MAIN_PRGRM - 574                |REVERSE  | |
| |       | N7:40/6 - -(L)- - File #2 MAIN_PRGRM - 574               |ENABLE   | |
| |PREPARE FOR | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          |MM7RE    | |
| |AUTO RUN    | N7:35/3 - -(U)- - File #2 MAIN_PRGRM - 574           |  N7:40  | |
| |>AUTO       | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          +---(U)---+ |
| |   N7:37    |                                                     |    6    | |
| +-----] [----+                                                     |         | |
|         1                                                          |MANUAL   | |
|  [162]                                                             |MOTOR 7  | |
|                                                                    |REVERSE  | |
|                                                                    |DISABLE  | |
|                                                                    |MM7RD    | |
|                                                                    |  N7:35  | |
|                                                                    +---(L)---+ |
|                                                                         3       |
```

```
Rung #594
| MOTOR 8                                                                          MOTOR 8   |
| REVERSE                                                                          REVERSE   |
| DISABLE                                                                          M8R       |
| M8RD                                                                               B3      |
|  N7:14                                                                                     |
|---] [---------------------------------------------------------------------------+--(U)--+-|
| |  4        |                                                                   |  108   | |
| |[3]        |                                                                   |        | |
| |           | B3/108 - ] [ - File #2 MAIN_PRGRM - 249                           |MANUAL  | |
| |           |          ]/[ - File #2 MAIN_PRGRM - 249                           |MOTOR 8 | |
| |           |         -(L)- - File #2 MAIN_PRGRM - 575                          |REVERSE | |
| |           | N7:40/7 - -(L)- - File #2 MAIN_PRGRM - 575                        |ENABLE  | |
| |PREPARE FOR| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |MM8RE   | |
| |AUTO RUN   | N7:35/4 - -(U)- - File #2 MAIN_PRGRM - 575                        | N7:40  | |
| |>AUTO      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       +--(U)---+ |
| |  N7:37    |                                                                   |   7    | |
| +---] [-----+                                                                   |        | |
|      1                                                                          |MANUAL  | |
|  [162]                                                                          |MOTOR 8 | |
|                                                                                 |REVERSE | |
|                                                                                 |DISABLE | |
|                                                                                 |MM8RD   | |
|                                                                                 | N7:35  | |
|                                                                                 +--(L)---+ |
|                                                                                     4      |

Rung #595
| MOTOR 9                                                                          MOTOR 9   |
| REVERSE                                                                          REVERSE   |
| DISABLE                                                                          M9R       |
| M9RD                                                                               B3      |
|  N7:14                                                                                     |
|---] [---------------------------------------------------------------------------+--(U)--+-|
| |  5        |                                                                   |  109   | |
| |[3]        |                                                                   |        | |
| |           | B3/109 - ] [ - File #2 MAIN_PRGRM - 255                           |MANUAL  | |
| |           |          ]/[ - File #2 MAIN_PRGRM - 253                           |MOTOR 9 | |
| |           |         -(L)- - File #2 MAIN_PRGRM - 576                          |REVERSE | |
| |           | N7:40/8 - -(L)- - File #2 MAIN_PRGRM - 576                        |ENABLE  | |
| |PREPARE FOR| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |MM9RE   | |
| |AUTO RUN   | N7:35/5 - -(U)- - File #2 MAIN_PRGRM - 576                        | N7:40  | |
| |>AUTO      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       +--(U)---+ |
| |  N7:37    |                                                                   |   8    | |
| +---] [-----+                                                                   |        | |
|      1                                                                          |MANUAL  | |
|  [162]                                                                          |MOTOR 9 | |
|                                                                                 |REVERSE | |
|                                                                                 |DISABLE | |
|                                                                                 |MM9RD   | |
|                                                                                 | N7:35  | |
|                                                                                 +--(L)---+ |
|                                                                                     5      |
```

```
Rung #596
| MOTOR 10                                                                                                   |
| REVERSE                                                                                      MOTOR 10      |
| DISABLE                                                                                      REVERSE       |
| M10RD                                                                                        M10R          |
|  N7:14                                                                                          B3         |
|-+--] [--+--------------------------------------------------------------------------------+----(U)----+---|
| |   6    |                                                                               |    110    |   |
| |[3]     |                                                                               |           |   |
| |        | B3/110 - ] [ - File #2 MAIN_PRGRM - 260                                        |MANUAL     |   |
| |        |          ]/[ - File #2 MAIN_PRGRM - 258                                        |MOTOR 10   |   |
| |        |          -(L)- - File #2 MAIN_PRGRM - 577                                      |REVERSE    |   |
| |        | N7:40/9 - -(L)- - File #2 MAIN_PRGRM - 577                                     |ENABLE     |   |
| |PREPARE FOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |MM10RE     |   |
| |AUTO RUN  | N7:35/6 - -(L)- - File #2 MAIN_PRGRM - 577                                     |  N7:40    |   |
| |>AUTO     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                    +----(U)----+   |
| |  N7:37   |                                                                                |     9     |   |
| +---] [----+                                                                                |           |   |
|      1                                                                                      |MANUAL     |   |
| [162]                                                                                       |MOTOR 10   |   |
|                                                                                             |REVERSE    |   |
|                                                                                             |DISABLE    |   |
|                                                                                             |MM10RD     |   |
|                                                                                             |  N7:35    |   |
|                                                                                             +----(L)----+   |
|                                                                                                  6          |
Rung #597
 MOTOR 11                                                                                                    |
| REVERSE                                                                                      MOTOR 11      |
| DISABLE                                                                                      REVERSE       |
| M11RD                                                                                        M11R          |
|  N7:14                                                                                          B3         |
|-+--] [--+--------------------------------------------------------------------------------+----(U)----+---|
| |   7    |                                                                               |    111    |   |
| |[3]     |                                                                               |           |   |
| |        | B3/111 - ] [ - File #2 MAIN_PRGRM - 265                                        |MANUAL     |   |
| |        |          ]/[ - File #2 MAIN_PRGRM - 263                                        |MOTOR 11   |   |
| |        |          -(L)- - File #2 MAIN_PRGRM - 578                                      |REVERSE    |   |
| |        | N7:40/10 - -(L)- - File #2 MAIN_PRGRM - 578                                    |ENABLE     |   |
| |PREPARE FOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |MM11RE     |   |
| |AUTO RUN  | N7:35/7 - -(U)- - File #2 MAIN_PRGRM - 578                                     |  N7:40    |   |
| |>AUTO     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                    +----(U)----+   |
| |  N7:37   |                                                                                |    10     |   |
| +---] [----+                                                                                |           |   |
|      1                                                                                      |MANUAL     |   |
| [162]                                                                                       |MOTOR 11   |   |
|                                                                                             |REVERSE    |   |
|                                                                                             |DISABLE    |   |
|                                                                                             |MM11RD     |   |
|                                                                                             |  N7:35    |   |
|                                                                                             +----(L)----+   |
|                                                                                                  7          |
```

```
Rung #598
| MOTOR 12                                                         MOTOR 12
| REVERSE                                                          REVERSE
| DISABLE                                                          M12R
| M12RD                                                               B3
|   N7:14
|-+--| |--+-----------------------------------------------------------+--(U)--+-
| |   8    |                                                          |  112   |
| |[3]     |                                                          |        |
| |        | B3/112 - -| |- - File #2 MAIN_PRGRM - 281                |MANUAL  |
| |        |          -|/|- - File #2 MAIN_PRGRM - 281                |MOTOR 12|
| |        |          -(L)- - File #2 MAIN_PRGRM - 579                |REVERSE |
| |        | N7:40/11 - -(L)- - File #2 MAIN_PRGRM - 579              |ENABLE  |
| |PREPARE FOR | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          |MM12RE  |
| |AUTO RUN  | N7:35/8 - -(U)- - File #2 MAIN_PRGRM - 579             | N7:40  |
| |>AUTO     | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2            +--(U)---+
| |   N7:37  |                                                        |  11    |
| +---| |----+                                                        |        |
|      1                                                              |MANUAL  |
| [162]                                                               |MOTOR 12|
|                                                                     |REVERSE |
|                                                                     |DISABLE |
|                                                                     |MM12RD  |
|                                                                     | N7:35  |
|                                                                     +--(L)---+
|                                                                        8

Rung #599
  MOTOR 13
| REVERSE                                                          MOTOR 13
| DISABLE                                                          REVERSE
| M13RD                                                            M13R
|   N7:14                                                             B3
|-+--| |--+-----------------------------------------------------------+--(U)--+-
| |   9    |                                                          |  113   |
| |[3]     |                                                          |        |
| |        | B3/113 - -| |- - File #2 MAIN_PRGRM - 287                |MANUAL  |
| |        |          -|/|- - File #2 MAIN_PRGRM - 285                |MOTOR 13|
| |        |          -(L)- - File #2 MAIN_PRGRM - 580                |REVERSE |
| |        | N7:40/12 - -(L)- - File #2 MAIN_PRGRM - 580              |ENABLE  |
| |PREPARE FOR | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2          |MM13RE  |
| |AUTO RUN  | N7:35/9 - -(U)- - File #2 MAIN_PRGRM - 580             | N7:40  |
| |>AUTO     | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2            +--(U)---+
| |   N7:37  |                                                        |  12    |
| +---| |----+                                                        |        |
|      1                                                              |MANUAL  |
| [162]                                                               |MOTOR 13|
|                                                                     |REVERSE |
|                                                                     |DISABLE |
|                                                                     |MM13RD  |
|                                                                     | N7:35  |
|                                                                     +--(L)---+
|                                                                        9
```

Rung #600

```
MOTOR 14                                                          MOTOR 14
REVERSE                                                           REVERSE
DISABLE                                                           M14R
M14RD                                                               B3
 N7:14                                                            --(U)--
--| |--                                                             114
   10
 [3]
            B3/114 - -| |- - File #2 MAIN_PRGRM - 292             MANUAL
                     -|/|- - File #2 MAIN_PRGRM - 290             MOTOR 14
                     -(L)- - File #2 MAIN_PRGRM - 581             REVERSE
            N7:40/13 - -(L)- - File #2 MAIN_PRGRM - 581           ENABLE
PREPARE FOR _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2           MM14RE
AUTO RUN    N7:35/10 - -(U)- - File #2 MAIN_PRGRM - 581             N7:40
>AUTO       _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2           --(U)--
   N7:37                                                            13
--| |--
   1                                                              MANUAL
 [162]                                                            MOTOR 14
                                                                  REVERSE
                                                                  DISABLE
                                                                  MM14RD
                                                                    N7:35
                                                                  --(L)--
                                                                    10
```

Rung #601

```
MOTOR 15                                                          MOTOR 15
REVERSE                                                           REVERSE
DISABLE                                                           M15R
M15RD                                                               B3
 N7:14                                                            --(U)--
--| |--                                                             115
   11
 [3]
            B3/115 - -| |- - File #2 MAIN_PRGRM - 297             MANUAL
                     -|/|- - File #2 MAIN_PRGRM - 295             MOTOR 15
                     -(L)- - File #2 MAIN_PRGRM - 582             REVERSE
            N7:40/14 - -(L)- - File #2 MAIN_PRGRM - 582           ENABLE
PREPARE FOR _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2           MM15RE
AUTO RUN    N7:35/11 - -(U)- - File #2 MAIN_PRGRM - 582             N7:40
>AUTO       _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2           --(U)--
   N7:37                                                            14
--| |--
   1                                                              MANUAL
 [162]                                                            MOTOR 15
                                                                  REVERSE
                                                                  DISABLE
                                                                  MM15RD
                                                                    N7:35
                                                                  --(L)--
                                                                    11
```

```
Rung #602
| MOTOR 16
| REVERSE                                                                                     MOTOR 16
| DISABLE                                                                                     REVERSE
| M16RD                                                                                       M16R
|   N7:14                                                                                       B3
|---| |---------------------------------------------------------------------------------------(U)---|
| |    12     |                                                                              |  116  |
| |[3]        |                                                                              |       |
| |           | B3/116 - -| |- - File #2 MAIN_PRGRM - 306                                   |MANUAL |
| |           |          -|/|- - File #2 MAIN_PRGRM - 306                                   |MOTOR 16
| |           |          -(L)- - File #2 MAIN_PRGRM - 583                                   |REVERSE|
| |           | N7:40/15 - -(L)- - File #2 MAIN_PRGRM - 583                                 |ENABLE |
| |PREPARE FOR| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                 |MM16RE |
| |AUTO RUN   | N7:35/12 - -(U)- - File #2 MAIN_PRGRM - 583                                 | N7:40 |
| |>AUTO      | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                 |--(U)--|
| |   N7:37   |                                                                              |  15   |
| |---| |-----|                                                                              |       |
|      1                                                                                     |MANUAL |
| [162]                                                                                      |MOTOR 16
|                                                                                            |REVERSE|
|                                                                                            |DISABLE|
|                                                                                            |MM16RD |
|                                                                                            | N7:35 |
|                                                                                            |--(L)--|
                                                                                                12

Rung #603
  MOTOR 17
| REVERSE                                                                                     MOTOR 17
| DISABLE                                                                                     REVERSE
| M17RD                                                                                       M17R
|   N7:14                                                                                       B3
|---| |---------------------------------------------------------------------------------------(U)---|
| |    13     |                                                                              |  117  |
| |[3]        |                                                                              |       |
| |           | B3/117 - -| |- - File #2 MAIN_PRGRM - 312                                   |MANUAL |
| |           |          -|/|- - File #2 MAIN_PRGRM - 310                                   |MOTOR 17
| |           |          -(L)- - File #2 MAIN_PRGRM - 584                                   |REVERSE|
| |           | N7:41/0 - -(L)- - File #2 MAIN_PRGRM - 584                                  |ENABLE |
| |PREPARE FOR| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                 |MM17RE |
| |AUTO RUN   | N7:35/13 - -(U)- - File #2 MAIN_PRGRM - 584                                 | N7:41 |
| |>AUTO      | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                 |--(U)--|
| |   N7:37   |                                                                              |   0   |
| |---| |-----|                                                                              |       |
|      1                                                                                     |MANUAL |
| [162]                                                                                      |MOTOR 17
|                                                                                            |REVERSE|
|                                                                                            |DISABLE|
|                                                                                            |MM17RD |
|                                                                                            | N7:35 |
|                                                                                            |--(L)--|
                                                                                                13
```

Rung #604

```
| MOTOR 18                                                          MOTOR 18  |
| REVERSE                                                           REVERSE   |
| DISABLE                                                           M18R      |
| M18RD                                                               B3      |
|   N7:14                                                                     |
|---] [---+------------------------------------------------------------(U)---|
|    14   |                                                         118       |
| [3]     |                                                                   |
|         | B3/118 - ] [ - File #2 MAIN_PRGRM - 317                 MANUAL    |
|         |          ]/[ - File #2 MAIN_PRGRM - 315                 MOTOR 18  |
|         |          -(L)- - File #2 MAIN_PRGRM - 585               REVERSE   |
|         | N7:41/1 - -(L)- - File #2 MAIN_PRGRM - 585              ENABLE    |
|PREPARE FOR | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2          MM18RE    |
|AUTO RUN | N7:35/14 - -(U)- - File #2 MAIN_PRGRM - 585               N7:41   |
|>AUTO    | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2             ---(U)--- |
|   N7:37 |                                                            1      |
|---] [---+                                                                   |
|     1                                                              MANUAL    |
| [162]                                                             MOTOR 18  |
|                                                                   REVERSE   |
|                                                                   DISABLE   |
|                                                                   MM18RD    |
|                                                                     N7:35   |
|                                                                   ---(L)--- |
|                                                                      14     |
```

Rung #605

```
| MOTOR 19                                                                    |
| REVERSE                                                           MOTOR 19  |
| DISABLE                                                           REVERSE   |
| M19RD                                                             M19R      |
|   N7:14                                                             B3      |
|---] [---+------------------------------------------------------------(U)---|
|    15   |                                                         119       |
| [3]     |                                                                   |
|         | B3/119 - ] [ - File #2 MAIN_PRGRM - 322                 MANUAL    |
|         |          ]/[ - File #2 MAIN_PRGRM - 320                 MOTOR 19  |
|         |          -(L)- - File #2 MAIN_PRGRM - 586               REVERSE   |
|         | N7:41/2 - -(L)- - File #2 MAIN_PRGRM - 586              ENABLE    |
|PREPARE FOR | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2          MM19RE    |
|AUTO RUN | N7:35/15 - -(U)- - File #2 MAIN_PRGRM - 586               N7:41   |
|>AUTO    | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2             ---(U)--- |
|   N7:37 |                                                            2      |
|---] [---+                                                                   |
|     1                                                              MANUAL    |
| [162]                                                             MOTOR 19  |
|                                                                   REVERSE   |
|                                                                   DISABLE   |
|                                                                   MM19RD    |
|                                                                     N7:35   |
|                                                                   ---(L)--- |
|                                                                      15     |
```

Rung #606

```
| MOTOR 20                                                              MOTOR 20
| REVERSE                                                               REVERSE
| DISABLE                                                               M20R
| M20RD                                                                   B3
|   N7:15
+---] [---+------------------------------------------------------------+--(U)--+
|     0   |                                                            |  120  |
| [3]     | B3/120 - ] [ - File #2 MAIN_PRGRM - 333                    |       |
|         |          ]/[ - File #2 MAIN_PRGRM - 331                    |MANUAL |
|         |          -(L)- - File #2 MAIN_PRGRM - 587                  |MOTOR 20
|         | N7:41/3 - -(L)- - File #2 MAIN_PRGRM - 587                 |REVERSE|
|PREPARE FOR| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              |ENABLE |
|AUTO RUN | N7:36/0 - -(U)- - File #2 MAIN_PRGRM - 587                 |MM20RE |
|>AUTO    | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                | N7:41 |
|   N7:37 |                                                            +--(U)--+
+---] [---+                                                            |   3   |
      1                                                                |MANUAL |
 [162]                                                                 |MOTOR 20
                                                                       |REVERSE|
                                                                       |DISABLE|
                                                                       |MM20RD |
                                                                       | N7:36 |
                                                                       +--(L)--+
                                                                           0
```

Rung #607

```
| MOTOR 21                                                              MOTOR 21
| REVERSE                                                               REVERSE
| DISABLE                                                               M21R
| M21RD                                                                   B3
|   N7:15
+---] [---+------------------------------------------------------------+--(U)--+
|     1   |                                                            |  121  |
| [3]     | B3/121 - ] [ - File #2 MAIN_PRGRM - 357                    |       |
|         |          ]/[ - File #2 MAIN_PRGRM - 355                    |MANUAL |
|         |          -(L)- - File #2 MAIN_PRGRM - 588                  |MOTOR 21
|         | N7:41/4 - -(L)- - File #2 MAIN_PRGRM - 588                 |REVERSE|
|PREPARE FOR| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              |ENABLE |
|AUTO RUN | N7:36/1 - -(U)- - File #2 MAIN_PRGRM - 588                 |MM21_RE|
|>AUTO    | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                | N7:41 |
|   N7:37 |                                                            +--(U)--+
+---] [---+                                                            |   4   |
      1                                                                |MANUAL |
 [162]                                                                 |MOTOR 21
                                                                       |REVERSE|
                                                                       |DISABLE|
                                                                       |MM21RD |
                                                                       | N7:36 |
                                                                       +--(L)--+
                                                                           1
```

Rung #608

```
 VNT1TMR                                                              AUTO VENT
  T4:168                                                              GREATER THEN
                                                                      3 MINUTES
                                                                      AUTOVENT>3M
                                                                          B3
+-+---] [---+-----------------------------------------------------------( )---+
  |    DN   |                                                            837
  |[406]    |
  |         | B3/837 - ] [ - File #2 MAIN_PRGRM - 624
  |VNT2TMR  |
  | T4:199  |
  +---] [---+
  |    DN   |
  |[412]    |
  |VNT3TMR  |
  | T4:242  |
  +---] [---+
  |    DN   |
  |[419]    |
  |VNT4TMR  |
  | T4:248  |
  +---] [---+
  |    DN   |
  |[426]    |
  |VNT5TMR  |
  | T4:252  |
  +---] [---+
  |    DN   |
  |[431]    |
  |SYSVNTPLSE
  |   T4:286|
  +---] [---+
       DN
 [370]
```

```
Rung #609
                                                                          AUTO PUMPDOWN
                                                                          >10 MINUTES
  PMP1TMR                                                                 PD>10M
  T4:256                                                                  B3
--] [---------------------------------------------------------------------( )--
    DN                                                                    838
 [435]
             B3/838 - ] [ - File #2 MAIN_PRGRM - 624
 PMP2TMR
  T4:262
 --] [--
    DN
 [439]
 PMP3TMR
  T4:288
 --] [--
    DN
 [443]
 PMP4TMR
  T4:295
 --] [--
    DN
 [448]
 PMP5TRM
  T4:296
 --] [--
    DN
 [452]
 PDSTMR
  T4:190
 --] [--
    DN
 [25]
Rung #610
PALLET      PALLET
DETECTED    DETECTED
LEFT SIDE   RIGHT SIDE                                                    SENSOR 1 AND
ENTRANCE    ENTRANCE                                                      SENSOR 3
SEN1        SEN3                                                          SEN1_3
  I:003       I:003                                                       B3
--] [---------] [---------------------------------------------------------( )--
   00          02                                                         51
Rung #611
FIX--A_B                                                          FIX A-B
COMM                                                              COMMUNICATIONS
CHECK                                                             TIMER
FIX_AB_COMM                                                       FIX__A-B_TMR
  B3                                                              +--TON----------+
--] [-------------------------------------------------------------|TIMER ON DELAY |-(EN)-
  525                                                             |TIMER:    T4:69|
                                                                  |BASE (SEC):  1.0|-(DN)
 T4:69.DN - ] [ - File #2 MAIN_PRGRM - 612                        |PRESET:      15|
                                                                  |ACCUM:        0|
                                                                  +---------------+
```

```
Rung #612
|FIX                                                                        FIX_A-B          |
|AB                                                                         COMMUNICATIONS   |
|TIMER                                                                      LOST!            |
|FIX__A-B_TMR                                                               NO_FX_A-B_COMM   |
|     T4:69                                                                      B3          |
|----| |----------------------------------------------------------------------(L)-----------|
|      DN                                                                        810         |
|[611]                                                                                       |
B3/810 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  612
         -(U)- - File #2 MAIN_PRGRM -  617
Rung #613
|ARGON GAS                                                                     NO ARGON    |
|PRESSURE                                                                      SIGNAL TO   |
|SENSOR                                                                        THE FIX     |
|NO_ARGON                                                                      NO=ARGON    |
|   I:052                                                                         B3       |
|----| |------------------------------------------------------------------------(L)-------|
|    03                                                                           809      |
B3/809 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  613
         -(U)- - File #2 MAIN_PRGRM -  617
Rung #614
|AUTO    PROCESS                                                                       |
|MODE    PRESSURE                                          PRESSURE FAIL               |
|ENABLE  FAILURE                                           TIMER                       |
 'JTO    PRESS_FAILURE                                     PRESS_FAIL_TMR              |
| N7:37       B3                                           +-TON-----------+           |
|--| |--------| |-----------------------------------------+-|TIMER ON DELAY |-(EN)-|
|  11        529                                           |TIMER:   T4:331|           |
|[158]                                                     |BASE (SEC): 1.0|-(DN)     |
|                                                          |PRESET:      10|           |
|                                                          |ACCUM:        0|           |
|                                                          +---------------+           |
T4:331.DN - -| |- - File #2 MAIN_PRGRM -  615
Rung #615
|                                                                          PRESSURE   |
|                                                                          FAILURE    |
|PRESS_FAIL_TMR                                                            PRESS_FAIL |
|     T4:331                                                                  B3      |
|-------| |-------------------------------------------------------------------(L)-----|
|       DN                                                                    388     |
|[614]                                                                                |
B3/388 - -| |- - File #2 MAIN_PRGRM -  627
         -(L)- - File #2 MAIN_PRGRM -  615
         -(U)- - File #2 MAIN_PRGRM -  617
Rung #616
|AUTO                                                                                 |
 ODE     ARGON FLOW                                                     NO_ARGON      |
|ENABLE  FAILURE                                                        LATCH         |
|AUTO    NO_ARGON_FLOW                                                  NO_ARGONLTCH  |
| N7:37       B3                                                            B3        |
|--| |--------| |------------------------------------------------------------(L)------|
|  11        528                                                           387       |
|[158]                                                                                |
B3/387 - -| |- - File #2 MAIN_PRGRM -  627
         -(L)- - File #2 MAIN_PRGRM -  616
         -(U)- - File #2 MAIN_PRGRM -  617
```

Rung #617

```
|PAUSE                                                              NO_ARGON        |
|DISABLE                                                            LATCH           |
|TS12                                                               NO_ARGONLTCH    |
| N7:16                                                                B3           |
|---| |------------------------------------------------------------+----(U)-------+-|
|    4                                                             |    387       | |
|[3]                                                               |              | |
| B3/387 - -| |- - File #2 MAIN_PRGRM - 627                        |              | |
|          -(L)- - File #2 MAIN_PRGRM - 616                        |PRESSURE      | |
| B3/388 - -| |- - File #2 MAIN_PRGRM - 627                        |FAILURE       | |
|          -(L)- - File #2 MAIN_PRGRM - 615                        |PRESS_FAIL    | |
| B3/272 - -| |- - File #2 MAIN_PRGRM - 627                        |   B3         | |
|          -(L)- - File #2 MAIN_PRGRM - 619                        +----(U)-------+ |
| B3/809 - -| |- - File #2 MAIN_PRGRM - 626                        |   388        | |
|          -(L)- - File #2 MAIN_PRGRM - 613                        |              | |
| B3/810 - -| |- - File #2 MAIN_PRGRM - 626                        |              | |
|          -(L)- - File #2 MAIN_PRGRM - 612                        |              | |
|                                                                  |ARC DETECT    | |
|                                                                  |LATCH         | |
|                                                                  |ARC_DET       | |
|                                                                  |   B3         | |
|                                                                  +----(U)-------+ |
|                                                                  |   272        | |
|                                                                  |NO ARGON      | |
|                                                                  |SIGNAL TO     | |
|                                                                  |THE FIX       | |
|                                                                  |NO=ARGON      | |
|                                                                  |   B3         | |
|                                                                  +----(U)-------+ |
|                                                                  |   809        | |
|                                                                  |FIX_A-B       | |
|                                                                  |COMMUNICATIONS| |
|                                                                  |LOST!         | |
|                                                                  |NO_FX_A-B_COMM| |
|                                                                  |     B3       | |
|                                                                  +-----(U)------+ |
|                                                                        810         |
```

```
Rung #618
| CHROME ARC                                                             ARC FAULT            |
| DETECT #1                                                              DELAY                |
| CHR_ARC1                                                               ARCFLTDLY            |
|     B3                                                                 +--TON------------+  |
|---] [-----+----------------------------------------------------------+-|TIMER ON DELAY   |-(EN)-|
| |   534   |                                                            |TIMER:    T4:100 |      |
| |         |                                                            |BASE (SEC):   1.0|-(DN) |
| |         | T4:100.DN - ] [ - File #2 MAIN_PRGRM - 619                 |PRESET:        10|      |
| |         |                                                            |ACCUM:          0|      |
| |MAG ARC  |                                                            +-----------------+      |
| |DETECT #1|                                                                                     |
| |MAG_ARC1 |                                                                                     |
| |   B3    |                                                                                     |
| |---] [---|                                                                                     |
| |   535   |                                                                                     |
| |CARBON ARC                                                                                     |
| |DETECT #1|                                                                                     |
| |CAR_ARC1 |                                                                                     |
| |   B3    |                                                                                     |
| |---] [---|                                                                                     |
| |   536   |                                                                                     |
| |CHROME ARC                                                                                     |
| |DETECT #2|                                                                                     |
| |CHR_ARC2 |                                                                                     |
| |   B3    |                                                                                     |
| |---] [---|                                                                                     |
| |   540   |                                                                                     |
| |MAG ARC  |                                                                                     |
| |DETECT #2|                                                                                     |
| |MAG_ARC2 |                                                                                     |
| |   B3    |                                                                                     |
| |---] [---|                                                                                     |
| |   541   |                                                                                     |
| |CARBON ARC                                                                                     |
| |DETECT #2|                                                                                     |
| |CAR_ARC2 |                                                                                     |
| |   B3    |                                                                                     |
| +---] [---+                                                                                     |
|     542                                                                                         |
Rung #619
|                                                                               ARC DETECT |
|                                                                               LATCH      |
|ARCFLTDLY                                                                      ARC_DET    |
| T4:100                                                                            B3     |
|---] [------------------------------------------------------------------------------(L)---|
|    DN                                                                            272     |
|[618]                                                                                     |
B3/272 - ] [ - File #2 MAIN_PRGRM -  627
       -(L)- - File #2 MAIN_PRGRM -  619
       -(U)- - File #2 MAIN_PRGRM -  617
```

```
Rung #620
                  CHROME
 HIGH POWER       POWER SUPPLY                                                POWER SUPPLY
 CHROME 1 & 2     SETPOINT ALARM                                              SETPOINT ALARM
 TO THE FIX       1                                                           DELAY
 HIPRCH1,2        CHRSPAL1                                                    PSSPALMDLY
      B3               B3                                                     +--TON--------------+
 ----] [---------------] [-----+----------------------------------------------+TIMER ON DELAY     +-(EN)-
      831              531     |                                              |TIMER:      T4:333 |
 [236]                         |                                              |BASE (SEC):   1.0  +-(DN)
                               | T4:333.DN - ] [ - File #2 MAIN_PRGRM - 621   |PRESET:         10 |
                               |                                              |ACCUM:           0 |
                  MAGNETIC     |                                              +-------------------+
 HIGH POWER       POWER SUPPLY |
 MAG 1 & 2        SETPOINT ALARM
 TO THE FIX       1            |
 HIMAG1,2         MAGSPAL1     |
      B3               B3      |
 ----] [---------------] [-----+
      833              532     |
 [268]                         |
                  CARBON       |
 HIGH POWER       POWER SUPPLY |
 CARBON 1 & 2     SETPOINT ALARM
 TO THE FIX       1            |
 HIPRCAR1,2       CARSPAL1     |
      B3               B3      |
 ----] [---------------] [-----+
      835              533     |
 [299]                         |
 HIGH POWER       CHROME PS    |
 CHROME 3 & 4     SETPOINT ALARM
 TO THE FIX       2            |
 HIPRCHR3,4       CHRSPAL2     |
      B3               B3      |
 ----] [---------------] [-----+
      832              537     |
 [242]                         |
 HIGH POWER       MAG PS       |
 MAG 3 & 4        SETPOINT ALARM
 TO THE FIX       2            |
 HIPRMAG3,4       MAGSPAL2     |
      B3               B3      |
 ----] [---------------] [-----+
      834              538     |
 [274]                         |
 HIGH POWER       CARBON PS    |
 CARBON 3 & 4     SETPOINT ALARM
 TO THE FIX       2            |
 'IPRCAR3,4       CARSPAL2     |
      B3               B3      |
 ----] [---------------] [-----+
      836              539
 [300]
Rung #621
                                                                              POWER SUPPLY
PSSPALMDLY                                                                    SETPOINT ALARM
 T4:333                                                                       PSSPALARM
                                                                                   B3
----] [-------------------------------------------------------------------------(L)----
     DN                                                                            147
[620]
```

```
B3/147 - -| |- - File #2 MAIN_PRGRM -  625
        -(L)- - File #2 MAIN_PRGRM -  621
        -(U)- - File #2 MAIN_PRGRM -  629
Rung #622
| HIGH POWER                                          POWER SUPPLY |
| CHROME 1 & 2                                        HIGH POWER   |
| TO THE FIX                                          ON           |
| HIPRCH1,2                                           HIPWRON      |
|      B3                                                   B3     |
|-+---| |---+-----------------------------------------------( )---|
| |   831   |                                               301    |
| |[236]    |                                                      |
| |HIGH POWER                                                      |
| |CHROME 3 & 4                                                    |
| |TO THE FIX                                                      |
| |HIPRCHR3,4                                                      |
| |    B3   |                                                      |
| |---| |---|                                                      |
| |   832   |                                                      |
| |[242]    |                                                      |
| |HIGH POWER                                                      |
| |MAG 1 & 2                                                       |
| |TO THE FIX                                                      |
| |HIMAG1,2 |                                                      |
| |    B3   |                                                      |
| |---| |---|                                                      |
| |   833   |                                                      |
| |[268]    |                                                      |
| |HIGH POWER                                                      |
| |MAG 3 & 4                                                       |
| |TO THE FIX                                                      |
| |HIPRMAG3,4                                                      |
| |    B3   |                                                      |
| |---| |---|                                                      |
| |   834   |                                                      |
| |[274]    |                                                      |
| |HIGH POWER                                                      |
| |CARBON 1 & 2                                                    |
| |TO THE FIX                                                      |
| |HIPRCAR1,2                                                      |
| |    B3   |                                                      |
| |---| |---|                                                      |
| |   835   |                                                      |
| |[299]    |                                                      |
| |HIGH POWER                                                      |
| |CARBON 3 & 4                                                    |
| |TO THE FIX                                                      |
| |HIPRCAR3,4                                                      |
| |    B3   |                                                      |
| +---| |---+                                                      |
|     836                                                          |
| [300]                                                            |
```

Rung #623

```
                                                        RERUF GREATER
                                                        THAN 10
                                                        TIMES
 C1RERUF                                                RERUF>10
  C5:1                                                  B3
--] [------------------------------------------------------( )--
   DN                                                   819
 [3:19]
          B3/819 - ] [ - File #2 MAIN_PRGRM - 624
 C2RERUF
  C5:2
--] [--
   DN
 [3:196]
 C2RERUF
  C5:2
--] [--
   DN
 [3:196]
 C3RERUF
  C5:3
--] [--
   DN
 [3:197]
 C4RERUF
  C5:4
--] [--
   DN
 [3:198]
 C5RERUF
  C5:5
--] [--
   DN
 [3:199]
 C6R3RUF
  C5:6
--] [--
   DN
 [3:200]
 C7RERUF
  C5:7
--] [--
   DN
 [3:201]
 C8RERUF
  C5:8
--] [--
   DN
 [3:202]
```

```
Rung #624
| PAUSE                                             PAUSE
| LATCH                             OSCILLATOR      LATCH                          ALARM LIGHT
| ENABLE                            2               ENABLE                         ALRMLITE
| PLE                               OSC2            PLE                             O:033
|  N7:37                                  B3        N7:37
+--+-] [-+-----------------------------+--] [------]/[-----------------------------( )---+
|  | 3                                 | | 143      3                              16
|  |[625]                              | |[11]      [625] |
|  |CRYO REGEN                         | |PAUSE           |
|  |ROUGHING                           | |LATCH           |
|  |TIMEOUT                            | |ENABLE  OSCILLATOR
|  |CR_RUFF_TIME                       | |PLE     OSC     |
|  |         B3                        | | N7:37     B3   |
|  +-------] [-------------------------+ +--] [------] [--+
|  |      818                          |    3        142
|  |[3:31]                             |  [625]   [7]
|  |RERUF GREATER                      |
|  |THAN 10                            |
|  |TIMES                              |
|  |RERUF>10                           |
|  |         B3                        |
|  +-------] [-------------------------+
|  |      819                          |
|  |[623]                              |
|  |CRYO REGEN                         |
|  |COOL DOWN                          |
|   >2 HOURS                           |
|  |CR_CD>2H                           |
|  |       B3                          |
|  +-----] [---------------------------+
|  |     820                           |
|  |[3:32]                             |
|  |AUTO VENT                          |
|  |GREATER THEN                       |
|  |3 MINUTES                          |
|  |AUTOVENT>3M                        |
|  |         B3                        |
|  +-------] [-------------------------+
|  |      837                          |
|  |[608]                              |
|  |PIRINI                             |
|  |GUAGE NO                           |
|  |FAULT                              |
|  |PGNF                               |
|  |     B3                            |
|  +----]/[----------------------------+
|  |   465                             |
|  |[5:205]                            |
|   AUTO PUMPDOWN                      |
|  |>10 MINUTES                        |
|  |PD>10M                             |
|  |         B3                        |
|  +-------] [-------------------------+
|  |      838                          |
|  |[609]                              |
|  |AUTO                               |
|  |MODE      POLYCOLD                 |
|  |ENABLE    SETPOINT LOW             |
|  |AUTO      PCSPL                    |
|  | N7:37          I:002              |
|  +--] [-----------]/[----------------+
|     11              02
>                                                                                        >
```

```
[158]
Rung #625
AUTO                                                              PAUSE
MODE          PAUSE                                               LATCH
ENABLE        ENABLE                                              ENABLE
AUTO          TS11                                                PLE
N7:37         N7:16                                               N7:37
--] [----------] [-------------------------------------------------(L)--
  11            3                                                  3
[158]         [3]
                    N7:37/3 - ] [ - File #2 MAIN_PRGRM - 624, 635, 636, 637, 638, 639, 640,
                              641, 642, 643, 644, 645, 646, 647, 648, 649, 650      PAUSE
                          ]/[ - File #2 MAIN_PRGRM - 181, 200, 215, 326, 327, 351, 624  LATCH
                          -(U)- - File #2 MAIN_PRGRM - 628                          DISABLE
PREPARE FOR   POWER SUPPLY  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2             PLD
AUTO RUN      SETPOINT ALARM N7:37/4 - -(L)- - File #2 MAIN_PRGRM - 628            N7:37
>AUTO         PSSPALARM     _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2           --(U)--
  N7:37          B3                                                                  4
--] [--       --] [--
    1            147
[162]         [621]
              DOOR FAULT
              DRFLT
                 B3
              --] [--
                 215
              [5:67]
              HIVAC VALVE
              FAULT
              HVFLT
                 B3
              --] [--
                 245
              [5:142]
              CHAMBER
              VENT VALVE
              FAULT
              CHVF
                 B3
              --] [--
                 174
              [5:157]
              ROUGH VENT
              VALVE
              FAULT
              RVVF
                 B3
              --] [--
                 386
              [5:180]
              HEATER
              SHIELD H2O
              FLOW FAULT
              HSFF
                 B3
              --] [--
                 219
              [5:200]
              CATHODE
              H2O FLOW
              FAULT
              CWFF
```

```
<                 <
|     B3          |
|----| |----------|
|    220          |
|[S:203]          |
|EMERGENCY        |
|STOP             |
|E_STOP           |
|    I:005        |
|-----|/|---------|
|      15         |
|AUXILLIARY       |
|PAUSE LATCH      |
|SIGNALS          |
|AUXPL            |
|      B3         |
|-----| |---------|
|      199        |
|[626]            |
|AUXILLIARY       |
|PAUSE 2 LATCH    |
|AUX2PL           |
|       B3        |
|------| |--------|
       390
 [627]
```

Rung #626

```
| NO ARGON                                                    AUXILLIARY |
| SIGNAL TO                                                   PAUSE LATCH|
| THE FIX                                                     SIGNALS    |
| NO=ARGON                                                    AUXPL      |
|    B3                                                          B3      |
|---] [---+-------------------------------------------------------( )----|
|| 809    |                                                      199     |
||[617]   |                                                              |
||        | B3/199 - ] [ - - File #2 MAIN_PRGRM - 625                    |
||FIX_A-B |                                                              |
||COMMUNICATIONS                                                         |
||LOST!   |                                                              |
||NO_FX_A-B_COMM                                                         |
||    B3  |                                                              |
||---] [------[AFI]                                                      |
||   810  |                                                              |
||[617]   |                                                              |
||MOTOR FAULT                                                            |
||TIMER DONE                                                             |
||MOTOR_FLT                                                              |
||    B3  |                                                              |
||---] [--+                                                              |
||   811  |                                                              |
||[5:15]  |                                                              |
||CHAMBER |                                                              |
||NOT AT  |                                                              |
 VACUUM   |                                                              |
||NO_VACUUM                                                              |
||    B3  |                                                              |
||---] [--+                                                              |
||   812  |                                                              |
||[633]   |                                                              |
||CRYO TEMP                                                              |
||ABOVE 20K                                                              |
||CRYO_>20K                                                              |
||    B3  |                                                              |
||---] [--+                                                              |
||   813  |                                                              |
||[630]   |                                                              |
||LOAD LOCK                                                              |
||VENT >30 SECS                                                          |
||LLVNT>30SECS                                                           |
||    B3  |                                                              |
||---] [--+                                                              |
||   814  |                                                              |
||[176]   |                                                              |
||EXIT LOCK                                                              |
||VENT>30 SECS                                                           |
 EXLKVNT>30SECS                                                          |
||    B3  |                                                              |
||---] [--+                                                              |
||   815  |                                                              |
||[349]   |                                                              |
||LOAD LOCK                                                              |
||ROUGHING|                                                              |
||>60 SECONDS                                                            |
||LLRUF>60|                                                              |
||    B3  |                                                              |
||---] [--+                                                              |
||   816  |                                                              |
||[170]   |                                                              |
||EXIT LOCK                                                              |
> >       >                                                              >
```

```
< <                               <
| |ROUGHING                       |
| |>60 SEC                        |
| |EXLKRUFF>60S                   |
| |         B3                    |
| |--------| |--------------------|
| |         817                   |
| |[343]                          |
| |CHAMBER                        |
| |COVERS                         |
| |CLOSED                         |
| |CCC                            |
| |     B3                        |
| |----| |----------------------- |
| |     467                       |
| |[5:207]                        |
| |MECHANICAL                     |
| |PUMP FAILURE                   |
| |MECH_P_FAIL                    |
| |         B3                    |
| +--------| |--------------------+
|           385
|  [5:188]
```

Rung #627

```
| ARC DETECT                                                          AUXILLIARY    |
| LATCH                                                               PAUSE 2 LATCH |
| ARC_DET                                                             AUX2PL        |
|     B3                                                                  B3        |
|----] [------+-----------------------------------------------------------( )-------|
| |   272     |                                                          390        |
| |[619]      |                                                                     |
| |           | B3/390 - ] [ - - File #2 MAIN_PRGRM - 625                           |
| |PRESSURE   |                                                                     |
| |FAILURE    |                                                                     |
| |PRESS_FAIL |                                                                     |
| |   B3      |                                                                     |
| |---] [-----|                                                                     |
| |   388     |                                                                     |
| |[617]      |                                                                     |
| |NO_ARGON   |                                                                     |
| |LATCH      |                                                                     |
| |NO_ARGONLTCH                                                                     |
| |   B3      |                                                                     |
| |---] [-----|                                                                     |
| |   387     |                                                                     |
| |[617]      |                                                                     |
| |AIR PRESSURE                                                                     |
| |SWITCH     |                                                                     |
| |APS        |                                                                     |
|    I:003    |                                                                     |
|  ----]/[----|                                                                     |
| |    17     |                                                                     |
| |HEATER ALARM                                                                     |
| |HTRALM     |                                                                     |
| |   B3      |                                                                     |
| |---] [-----|                                                                     |
| |   290     |                                                                     |
| |[152]      |                                                                     |
| |HEATER     |                                                                     |
| |SUPPLY     |                                                                     |
| |ALARM      |                                                                     |
| |HTRFLT     |                                                                     |
| |  B3       |                                                                     |
| +--] [------+                                                                     |
|   289                                                                             |
|  [631]                                                                            |
```

```
BASE :  Rung #628
| ARC DETECT                                                                AUXILLIARY    |
| LATCH                                                                     PAUSE 2 LATCH |
| ARC_DET                                                                   AUX2PL        |
|      B3                                                                      B3         |
|--+---] [-------+----------------------------------------------------------------( )------|
| |      272     |                                                                390       |
| |[620]         |                                                                          |
| |              | B3/390 - ] [ - File #2 MAIN_PRGRM - 626                                  |
| |PRESSURE      |                                                                          |
| |FAILURE       |                                                                          |
| |PRESS_FAIL    |                                                                          |
| |      B3      |                                                                          |
| |---] [--------|                                                                          |
| |    388       |                                                                          |
| |[618]         |                                                                          |
| |NO_ARGON      |                                                                          |
| |LATCH         |                                                                          |
| |NO_ARGONLTCH  |                                                                          |
| |      B3      |                                                                          |
| |---] [--------|                                                                          |
| |     387      |                                                                          |
| |[618]         |                                                                          |
| |AIR PRESSURE  |                                                                          |
| |SWITCH        |                                                                          |
| |APS           |                                                                          |
| |    I:003     |                                                                          |
|  ----]/[-------|                                                                          |
| |     17       |                                                                          |
| |   HEATER ALARM                                                                          |
| |   HTRALM     |                                                                          |
| |        B3    |                                                                          |
| |-[AFI]---] [--|                                                                          |
| |        290   |                                                                          |
| |      [152]   |                                                                          |
| |HEATER        |                                                                          |
| |SUPPLY        |                                                                          |
| |ALARM         |                                                                          |
| |HTRFLT        |                                                                          |
| |   B3         |                                                                          |
| +--] [---------+                                                                          |
|    289                                                                                    |
|  [632]                                                                                    |
```

401

```
Rung #629
|PAUSE                                                          POWER SUPPLY
|DISABLE                                                        SETPOINT ALARM
|TS12                                                           PSSPALARM
| N7:16                                                              B3
|---] [---------------------------------------------------------+----(U)----+
|    4                                                          |    147    |
|[3]                                                            |           |
| B3/147 - -] [- - File #2 MAIN_PRGRM - 625                     |           |
|          -(L)- - File #2 MAIN_PRGRM - 621                     |STOP MOTOR 6
| B3/474 - -]/[- - File #2 MAIN_PRGRM - 218                     |PAUSE LATCH
|          -(L)- - File #2 MAIN_PRGRM - 638                     |M6PL       |
| B3/475 - -]/[- - File #2 MAIN_PRGRM - 258                     |    B3     |
|          -(L)- - File #2 MAIN_PRGRM - 641                     +----(U)----+
| B3/476 - -]/[- - File #2 MAIN_PRGRM - 290                     |    474    |
|          -(L)- - File #2 MAIN_PRGRM - 644                     |           |
| B3/477 - -]/[- - File #2 MAIN_PRGRM - 315                     |           |
|          -(L)- - File #2 MAIN_PRGRM - 647                     |           |
|                                                               |STOP MOTOR 10
|                                                               |PAUSE LATCH
|                                                               |M10PL      |
|                                                               |    B3     |
|                                                               +----(U)----+
|                                                               |    475    |
|                                                               |STOP MOTOR 14
|                                                               |PAUSE LATCH
|                                                               |M14PL      |
|                                                               |    B3     |
|                                                               +----(U)----+
|                                                               |    476    |
|                                                               |STOP MOTOR 18
|                                                               |PAUSE LATCH
|                                                               |M18PL      |
|                                                               |    B3     |
|                                                               +----(U)----+
|                                                                    477
```

402

Rung #630

```
|AUTO      CRYO 1                                                    CRYO TEMP |
|MODE      TEMPERATUR                                                ABOVE 20K |
|ENABLE    =<20K                                                     CRYO_>20K |
|AUTO      CY1TMP20                                                     B3     |
| N7:37       B3                                                               |
|--| |----+---|/|---+----------------------------------------------------(L)---|
|   11    |   501   |                                                  813     |
|[158]    |         |                                                          |
|         |         | B3/813 - -| |- - File #2 MAIN_PRGRM - 626                 |
|         |CRYO 2   |          -(U)- - File #2 MAIN_PRGRM - 632                 |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY2TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   502   |                                                          |
|         |CRYO 3   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY3TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   503   |                                                          |
|         |CRYO 4   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY4TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   504   |                                                          |
|         |CRYO 5   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY5TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   505   |                                                          |
|         |CRYO 6   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY6TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   506   |                                                          |
|         |CRYO 7   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY7TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   507   |                                                          |
|         |CRYO 8   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY8TMP20 |                                                          |
|         |   B3    |                                                          |
|         +---|/|---+                                                          |
|         |   508   |                                                          |
|         |CRYO 9   |                                                          |
|         |TEMPERATUR                                                          |
|         |=<20K    |                                                          |
|         |CY9TMP20 |                                                          |
>         >         >                                                          >
```

```
<            <            <                                         <
|            |    B3      |                                         |
|            |---|/|------|                                         |
|            |   509      |                                         |
|            |CRYO 10     |                                         |
|            |TEMPERATUR  |                                         |
|            |=<20K       |                                         |
|            |CY10TMP20   |                                         |
|            |    B3      |                                         |
|            |---|/|------|                                         |
|            |   510      |                                         |
|            |CRYO 11     |                                         |
|            |TEMPERATUR  |                                         |
|            |=<20K       |                                         |
|            |CY11TMP20   |                                         |
|            |    B3      |                                         |
|            |---|/|------|                                         |
|            |   511      |                                         |
|            |CRYO 12     |                                         |
|            |TEMPERATUR  |                                         |
|            |=<20K       |                                         |
|            |CY12TMP20   |                                         |
|            |    B3      |                                         |
|            +---|/|------+                                         |
|                512                                                |
```

404

Rung #631

```
|AUTO                                                              HEATER |
|MODE     HEATER 1A                                                SUPPLY |
|ENABLE   NO FAULT                                                 ALARM  |
|AUTO     H1AOFLT                                                  HTRFLT |
| N7:37     I:025                                                    B3   |
|--| |------|/|---+-----------------------------------------------( )---|
|   11   |  06    |                                                 289   |
|[158]   |        |                                                       |
|        |        | B3/289 - -| |- - File #2 MAIN_PRGRM - 627              |
|        |HEATER 1B|                                                      |
|        |NO FAULT |                                                      |
|        |H1BOFLT  |                                                      |
|        |  I:025  |                                                      |
|        |---|/|---|                                                      |
|        |   07    |                                                      |
|        |HEATER 2A|                                                      |
|        |NO FAULT |                                                      |
|        |H2AOFLT  |                                                      |
|        |  I:025  |                                                      |
|        |---|/|---|                                                      |
|        |   10    |                                                      |
|        |HEATER 2B|                                                      |
|        |NOFAULT  |                                                      |
|        |H2BOFLT  |                                                      |
|        |  I:025  |                                                      |
|        |---|/|---|                                                      |
|        |   11    |                                                      |
|        |HEATER 2C|                                                      |
|        |NO FAULT |                                                      |
|        |H2COFLT  |                                                      |
|        |  I:026  |                                                      |
|        |---|/|---|                                                      |
|        |   04    |                                                      |
|        |HEATER 3A|                                                      |
|        |NO FAULT |                                                      |
|        |H3AOFLT  |                                                      |
|        |  I:026  |                                                      |
|        |---|/|---|                                                      |
|        |   05    |                                                      |
|        |HEATER 3B|                                                      |
|        |NO FAULT |                                                      |
|        |H3BOFLT  |                                                      |
|        |  I:026  |                                                      |
|        |---|/|---|                                                      |
|        |   06    |                                                      |
|        |HEATER 3C|                                                      |
|        |NO FAULT |                                                      |
|        |H3COFLT  |                                                      |
|        |  I:026  |                                                      |
|        +---|/|---+                                                      |
|            07                                                            |
```

Rung #632

```
|PAUSE                                                          CRYO TEMP |
|DISABLE                                                        ABOVE 20K |
|TS12                                                           CRYO_>20K |
|  N7:16                                                            B3    |
|---| |----------------------------------------------------------(U)-----|
|    4                                                             813    |
|[3]                                                                      |
B3/813 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  630
```

```
    -(U)- - File #2 MAIN_PRGRM -  632
Rung #633
|
|AUTO      HEATER 1                                            CHAMBER    |
|MODE      CHAMBER                                             NOT AT     |
|ENABLE    =<250                                               VACUUM     |
|AUTO      MICRONS                                             NO_VACUUM  |
| N7:37    PIR2                                                   B3      |
|            I:004                                                        |
|--| |----+---|/|---+------------------------------------------(L)------|
|  11     |    10    |                                           812      |
|[158]    |          |                                                    |
|         |CHROME    | B3/812 - -| |- - File #2 MAIN_PRGRM - 626         |
|         |CHAMBER   |        -(U)- - File #2 MAIN_PRGRM - 634           |
|         |=<250     |                                                    |
|         |MICRONS   |                                                    |
|         |PIR6      |                                                    |
|         |  I:024   |                                                    |
|         |---|/|----|                                                    |
|         |   07     |                                                    |
|         |MAGNETIC  |                                                    |
|         |CHAMBER   |                                                    |
|         |=<250     |                                                    |
|         |MICRONS   |                                                    |
|         |PIR11     |                                                    |
|         |  I:040   |                                                    |
|         |---|/|----|                                                    |
|         |   07     |                                                    |
|         |CARBON    |                                                    |
|         |CHAMBER   |                                                    |
|         |=<250     |                                                    |
|         |MICRONS   |                                                    |
|         |PIR16     |                                                    |
|         |  I:054   |                                                    |
|         |---|/|----|                                                    |
|         |   07     |                                                    |
|         |EXIT BUFFER|                                                   |
|         |CHAMBER   |                                                    |
|         |=<250     |                                                    |
|         |MICRONS   |                                                    |
|         |PIR15     |                                                    |
|         |    I:040 |                                                    |
|         +----|/|---+                                                    |
|               13                                                         |
Rung #634
|                                                              CHAMBER    |
|PAUSE                                                         NOT AT     |
|DISABLE                                                       VACUUM     |
|TS12                                                          NO_VACUUM  |
 N7:16                                                            B3      |
|--| |---------------------------------------------------------(U)------|
|  4                                                             812      |
|[3]                                                                      |
B3/812 - -| |- - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  633
        -(U)- - File #2 MAIN_PRGRM -  634
```

Rung #635
```
|        PALLET      PALLET                                                              |
|PAUSE   DETECTED    DETECTED                                             PAUSE PALLET   |
|LATCH   LEFT SIDE   RIGHT SIDE                                           IN ENTRANCE    |
|ENABLE  ENTRANCE    ENTRANCE                                             MOTOR 3        |
|PLE     SEN1        SEN3                                                 M3PLL          |
| N7:37     I:003       I:003                                                 B3        |
|--| |-------| |---------| |--------------------------------------------------(L)-------|
|  3          00          02                                                  473        |
|[628]                                                                                   |
B3/473 - -|/|- - File #2 MAIN_PRGRM -  185,187
         -(L)- - File #2 MAIN_PRGRM -  635
         -(U)- - File #2 MAIN_PRGRM -  628
```
Rung #636
```
|        PALLET      PALLET                                               PAUSE          |
|PAUSE   DETECTED    DETECTED                                             PALLET IN      |
|LATCH   LEFT SIDE   RIGHT SIDE                                           LLOCK          |
|ENABLE  LOADLOCK    LOADLOCK                                             MOTOR 4        |
|PLE     SEN4        SEN6                                                 M4PLL          |
| N7:37     I:003       I:003                                                 B3        |
|--| |-------| |---------| |--------------------------------------------------(L)-------|
|  3          03          05                                                  401        |
|[628]                                                                                   |
B3/401 - -|/|- - File #2 MAIN_PRGRM -  190,192
         -(L)- - File #2 MAIN_PRGRM -  636
         -(U)- - File #2 MAIN_PRGRM -  628
```
.ng #637
```
|        PALLET      PALLET                                               PAUSE          |
|PAUSE   DETECTED    DETECTED                                             PALLET IN      |
|LATCH   LEFT SIDE   RIGHT SIDE                                           HEATER 1       |
|ENABLE  HEATER 1    HEATER 1                                             MOTOR 5        |
|PLE     SEN7        SEN9                                                 M5PH1          |
| N7:37     I:003       I:003                                                 B3        |
|--| |-------| |---------| |--------------------------------------------------(L)-------|
|  3          06          10                                                  402        |
|[628]                                                                                   |
B3/402 - -|/|- - File #2 MAIN_PRGRM -  195,195,197
         -(L)- - File #2 MAIN_PRGRM -  637
         -(U)- - File #2 MAIN_PRGRM -  628
```
Rung #638
```
|        PALLET      PALLET                                                              |
|PAUSE   DETECTED    DETECTED                                                            |
|LATCH   LEFT SIDE   RIGHT SIDE                                           STOP MOTOR 6   |
|ENABLE  HEATER 1    HEATER 1                                             PAUSE LATCH    |
|PLE     SEN7        SEN9                                                 M6PL           |
| N7:37     I:003       I:003                                                 B3        |
|--| |-------| |---------| |--------------------------------------------------(L)-------|
|  3          06          10                                                  474        |
  .8]                                                                                    |
B3/474 - -|/|- - File #2 MAIN_PRGRM -  218
         -(L)- - File #2 MAIN_PRGRM -  638
         -(U)- - File #2 MAIN_PRGRM -  629
```
Rung #639
```
|        PALLET      PALLET                                               PAUSE          |
|PAUSE   DETECTED    DETECTED                                             PALLET IN      |
|LATCH   LEFT SIDE   RIGHT SIDE                                           DWELL 1        |
|ENABLE  DWELL 1     DWELL 1                                              MOTOR 7        |
|PLE     SEN13       SEN15                                                M7PD1          |
| N7:37     I:003       I:003                                                 B3        |
|--| |-------| |---------| |--------------------------------------------------(L)-------|
|  3          14          16                                                  403        |
|[628]                                                                                   |
```

```
B3/403 - -|/|- - File #2 MAIN_PRGRM -  231,231,233
        -(L)- - File #2 MAIN_PRGRM -  639
        -(U)- - File #2 MAIN_PRGRM -  628
Rung #640
|        PALLET      PALLET                                                PAUSE       |
|PAUSE   DETECTED    DETECTED                                              PALLET IN   |
|LATCH   LEFT SIDE   RIGHT SIDE                                            DWELL 2     |
|ENABLE  DWELL 2     DWELL 2                                               MOTOR 9     |
|PLE     SEN19       SEN21                                                 M9PD2       |
| N7:37     I:023       I:023                                                B3      |
|--| |-------| |-------| |---------------------------------------------------(L)------|
| 3          03          05                                                  404     |
|[628]                                                                               |
B3/404 - -|/|- - File #2 MAIN_PRGRM -  253,255
        -(L)- - File #2 MAIN_PRGRM -  640
        -(U)- - File #2 MAIN_PRGRM -  628
Rung #641
|        PALLET      PALLET                                                            |
|PAUSE   DETECTED    DETECTED                                                          |
|LATCH   LEFT SIDE   RIGHT SIDE                                        STOP MOTOR 10   |
|ENABLE  DWELL 2     DWELL 2                                           PAUSE LATCH     |
|PLE     SEN19       SEN21                                             M10PL           |
| N7:37     I:023       I:023                                              B3          |
|--| |-------| |-------| |-------------------------------------------------(L)--------|
| 3          03          05                                                475         |
'"528]                                                                                 |
  475 - -|/|- - File #2 MAIN_PRGRM -  258
        -(L)- - File #2 MAIN_PRGRM -  641
        -(U)- - File #2 MAIN_PRGRM -  629
Rung #642
|        PALLET      PALLET                                                PAUSE       |
|PAUSE   DETECTED    DETECTED                                              PALLET IN   |
|LATCH   LEFT SIDE   RIGHT SIDE                                            DWELL 3     |
|ENABLE  DWELL 3     DWELL 3                                               MOTOR 11    |
|PLE     SEN25       SEN27                                                 M11PD3      |
| N7:37     I:023       I:023                                                B3      |
|--| |-------| |-------| |---------------------------------------------------(L)------|
| 3          11          13                                                  405     |
|[628]                                                                               |
B3/405 - -|/|- - File #2 MAIN_PRGRM -  263,265
        -(L)- - File #2 MAIN_PRGRM -  642
        -(U)- - File #2 MAIN_PRGRM -  628
Rung #643
|        PALLET      PALLET      PALLET                                    PAUSE       |
|PAUSE   DETECTED    DETECTED    DETECTED                                  PALLET IN   |
|LATCH   LEFT SIDE   RIGHT SIDE  CENTER                                    DWELL 4     |
|ENABLE  DWELL 4     DWELL 4     MAGNETIC                                  MOTOR 13    |
'PLE     SEN31       SEN33       SEN29                                     M13PD4      |
 i7:37     I:037       I:037       I:037                                     B3      |
|--| |-------| |-------| |-------|/|------------------------------------------(L)------|
| 3          03          05          01                                      406     |
|[628]                                                                               |
B3/406 - -|/|- - File #2 MAIN_PRGRM -  285,287
        -(L)- - File #2 MAIN_PRGRM -  643
        -(U)- - File #2 MAIN_PRGRM -  628
```

```
Rung #644
|        PALLET     PALLET                                          |
|PAUSE   DETECTED   DETECTED                                        |
|LATCH   LEFT SIDE  RIGHT SIDE                       STOP MOTOR 14  |
|ENABLE  DWELL 4    DWELL 4                          PAUSE LATCH    |
|PLE     SEN31      SEN33                            M14PL          |
| N7:37    I:037      I:037                              B3         |
|--| |------| |--------| |--------------------------------(L)-------|
|  3        03         05                                476        |
|[628]                                                              |
B3/476 - -|/|- - File #2 MAIN_PRGRM -  290
         -(L)- - File #2 MAIN_PRGRM -  644
         -(U)- - File #2 MAIN_PRGRM -  629
Rung #645
|        PALLET     PALLET                                PAUSE     |
|PAUSE   DETECTED   DETECTED                              PALLET IN |
|LATCH   LEFT SIDE  RIGHT SIDE                            DWELL 5   |
|ENABLE  DWELL 5    DWELL 5                               MOTOR 15  |
|PLE     SEN37      SEN39                                 M15PD5    |
| N7:37    I:037      I:037                                  B3     |
|--| |------| |--------| |------------------------------------(L)---|
|  3        11         13                                    407    |
|[628]                                                              |
B3/407 - -|/|- - File #2 MAIN_PRGRM -  295,297
         -(L)- - File #2 MAIN_PRGRM -  645
         -(U)- - File #2 MAIN_PRGRM -  628
 .ng #646
|        PALLET     PALLET      PALLET                    PAUSE     |
|PAUSE   DETECTED   DETECTED    DETECTED                  PALLET IN |
|LATCH   LEFT SIDE  RIGHT SIDE  CENTER                    DWELL 6   |
|ENABLE  DWELL 6    DWELL 6     CARBON                    MOTOR 17  |
|PLE     SEN43      SEN45       SEN41                     M17PD6    |
| N7:37    I:053      I:053       I:053                      B3     |
|--| |------| |--------| |---------|/|------------------------(L)---|
|  3        03         05          01                        408    |
|[628]                                                              |
B3/408 - -|/|- - File #2 MAIN_PRGRM -  310,312
         -(L)- - File #2 MAIN_PRGRM -  646
         -(U)- - File #2 MAIN_PRGRM -  628
Rung #647
|        PALLET     PALLET                                          |
|PAUSE   DETECTED   DETECTED                                        |
|LATCH   LEFT SIDE  RIGHT SIDE                       STOP MOTOR 18  |
|ENABLE  DWELL 6    DWELL 6                          PAUSE LATCH    |
|PLE     SEN43      SEN45                            M18PL          |
| N7:37    I:053      I:053                              B3         |
|--| |------| |--------| |--------------------------------(L)-------|
   3        03         05                                477        |
  28]                                                               |
B3/477 - -|/|- - File #2 MAIN_PRGRM -  315
         -(L)- - File #2 MAIN_PRGRM -  647
         -(U)- - File #2 MAIN_PRGRM -  629
Rung #648
|        PALLET     PALLET                               PAUSE      |
|PAUSE   DETECTED   DETECTED                             PALLET IN  |
|LATCH   LEFT SIDE  RIGHT SIDE                           EXITBUFFER |
|ENABLE  EXBUFFER   EXBUFFER                             MOTOR 19   |
|PLE     SEN49      SEN51                                M19PXB     |
| N7:37    I:053      I:053                                  B3     |
|--| |------| |--------| |------------------------------------(L)---|
|  3        11         13                                    409    |
|[628]                                                              |
```

```
B3/409 - -|/|- - File #2 MAIN_PRGRM -  320,322
         -(L)- - File #2 MAIN_PRGRM -  648
         -(U)- - File #2 MAIN_PRGRM -  628
```

Rung #649

```
|         PALLET     PALLET                                        PAUSE PALLET |
|PAUSE    DETECTED   DETECTED                                      EXITLOCK     |
|LATCH    LEFT SIDE  RIGHT SIDE                                    MOTOR 20     |
|ENABLE   EXIT LOCK  EXLOCK                                        PAUSE        |
|PLE      SEN52      SEN54                                         M20PXL       |
| N7:37     I:053      I:053                                           B3       |
|-] [--------] [--------] [------------------------------------------(L)-------|
|  3          14         16                                           490       |
|[628]                                                                          |
B3/490 - -|/|- - File #2 MAIN_PRGRM -  331,333
         -(L)- - File #2 MAIN_PRGRM -  649
         -(U)- - File #2 MAIN_PRGRM -  628
```

Rung #650

```
|         PALLET     PALLET                                        PAUSE        |
|PAUSE    DETECTED   DETECTED                                      PALLET AT    |
|LATCH    LEFT SIDE  RIGHT SIDE                                    EXIT         |
|ENABLE   EXIT END   EXIT END                                      MOTOR 21     |
|PLE      SEN55      SEN57                                         M21PPX       |
| N7:37     I:053      I:054                                           B3       |
|-] [--------] [--------] [------------------------------------------(L)-------|
|  3          17         17                                           410       |
|[628]                                                                          |
 '410 - -|/|- - File #2 MAIN_PRGRM -  355,357
        -(L)- - File #2 MAIN_PRGRM -  650
        -(U)- - File #2 MAIN_PRGRM -  628
```

Rung #651

```
|LLOCK                                                                          |
|CHAMBER                                                           SCREEN       |
|PRESSUR AT                                                        AREA 1       |
|ATMOSPHERE                                                        VENTED       |
|PS2                                                               V1DN         |
|   I:002                                                              B3       |
|------] [-------------------------------------------------------------(L)-----|
|      04                                                             821       |
B3/821 - -(L)- - File #2 MAIN_PRGRM -  651
         -(U)- - File #2 MAIN_PRGRM -  652
```

Rung #652

```
|HEATER 1                                                                       |
|CHAMBER                                                           SCREEN       |
|=<250                                                             AREA 1       |
|MICRONS                                                           VENTED       |
|PIR2                                                              V1DN         |
|  I:004                                                               B3       |
|------] [-------------------------------------------------------------(U)-----|
      10                                                              821       |
B3/821 - -(L)- - File #2 MAIN_PRGRM -  651
         -(U)- - File #2 MAIN_PRGRM -  652
```

Rung #653

```
|DWELL 1                                                                        |
|CHAMBER                                                           SCREEN       |
|PRESSUR AT                                                        AREA 1       |
|ATMOSPHERE                                                        VENTED       |
|PS3                                                               V2DN         |
|   I:002                                                              B3       |
|------] [-------------------------------------------------------------(L)-----|
|      05                                                             822       |
B3/822 - -(L)- - File #2 MAIN_PRGRM -  653
         -(U)- - File #2 MAIN_PRGRM -  654
```

410

```
Rung #654
|CHROME                                                                  |
|CHAMBER                                                          SCREEN |
|=<250                                                            AREA 1 |
|MICRONS                                                          VENTED |
|PIR6                                                             V2DN   |
|  I:024                                                              B3 |
|--] [-------------------------------------------------------------(U)---|
|  07                                                                822 |
B3/822 - -(L)- - File #2 MAIN_PRGRM -  653
         -(U)- - File #2 MAIN_PRGRM -  654
Rung #655
|DWELL 3                                                                 |
|CHAMBER                                                          SCREEN |
|PRESSUR AT                                                       AREA 3 |
|ATMOSPHERE                                                       VENTED |
|PS4                                                              V3DN   |
|  I:022                                                              B3 |
|--] [-------------------------------------------------------------(L)---|
|  04                                                                823 |
B3/823 - -(L)- - File #2 MAIN_PRGRM -  655
         -(U)- - File #2 MAIN_PRGRM -  656
Rung #656
|MAGNETIC                                                                |
|CHAMBER                                                          SCREEN |
|=<250                                                            AREA 3 |
  CRONS                                                           VENTED |
|PIR11                                                            V3DN   |
|  I:040                                                              B3 |
|--] [-------------------------------------------------------------(U)---|
|  07                                                                823 |
B3/823 - -(L)- - File #2 MAIN_PRGRM -  655
         -(U)- - File #2 MAIN_PRGRM -  656
Rung #657
|DWELL 5                                                                 |
|CHAMBER                                                          SCREEN |
|PRESSUR AT                                                       AREA 4 |
|ATMOSPHERE                                                       VENTED |
|PS5                                                              V4DN   |
|  I:036                                                              B3 |
|--] [-------------------------------------------------------------(L)---|
|  04                                                                824 |
B3/824 - -(L)- - File #2 MAIN_PRGRM -  657
         -(U)- - File #2 MAIN_PRGRM -  658
Rung #658
|CARBON                                                                  |
|CHAMBER                                                          SCREEN |
|=<250                                                            AREA 4 |
  CRONS                                                           VENTED |
|PIR16                                                            V4DN   |
|  I:054                                                              B3 |
|--] [-------------------------------------------------------------(U)---|
|  07                                                                824 |
B3/824 - -(L)- - File #2 MAIN_PRGRM -  657
         -(U)- - File #2 MAIN_PRGRM -  658
Rung #659
|EXLOCK                                                                  |
|CHAMBER                                                          SCREEN |
|PRESSUR AT                                                       AREA 5 |
|ATMOSPHERE                                                       VENTED |
|PS6                                                              V5DN   |
|  I:052                                                              B3 |
|--] [-------------------------------------------------------------(L)---|
>                                                                        >
```

```
<                                                                        <
|    04                                                              825 |
B3/825 - -(L)- - File #2 MAIN_PRGRM -  659
       -(U)- - File #2 MAIN_PRGRM -  660
Rung #660
|EXIT BUFFER                                                             |
|CHAMBER                                                          SCREEN |
|=<250                                                            AREA 5 |
|MICRONS                                                         VENTED  |
|PIR15                                                            V5DN   |
|   1:040                                                            B3  |
|----] [---------------------------------------------------------(U)----|
|     13                                                            825  |
B3/825 - -(L)- - File #2 MAIN_PRGRM -  659
       -(U)- - File #2 MAIN_PRGRM -  660
Rung #661
|HEATER 1                                                                |
|CHAMBER                                                          SCREEN |
|=<250                                                            AREA 1 |
|MICRONS                                                          PUMPED |
|PIR2                                                             P1DN   |
|  1:004                                                             B3  |
|----] [---------------------------------------------------------(L)----|
|    10                                                             826  |
B3/826 - -(L)- - File #2 MAIN_PRGRM -  661
       -(U)- - File #2 MAIN_PRGRM -  662
:ng #662
|LLOCK                                                                   |
|CHAMBER                                                          SCREEN |
|PRESSUR AT                                                       AREA 1 |
|ATMOSPHERE                                                       PUMPED |
|PS2                                                              P1DN   |
|   1:002                                                            B3  |
|----] [---------------------------------------------------------(U)----|
|    04                                                             826  |
B3/826 - -(L)- - File #2 MAIN_PRGRM -  661
       -(U)- - File #2 MAIN_PRGRM -  662
Rung #663
|CHROME                                                                  |
|CHAMBER                                                          SCREEN |
|=<250                                                            AREA 2 |
|MICRONS                                                          PUMPED |
|PIR6                                                             P2DN   |
|  1:024                                                             B3  |
|----] [---------------------------------------------------------(L)----|
|    07                                                             827  |
B3/827 - -(L)- - File #2 MAIN_PRGRM -  663
       -(U)- - File #2 MAIN_PRGRM -  664
ing #664
|DWELL 1                                                                 |
|CHAMBER                                                          SCREEN |
|PRESSUR AT                                                       AREA 2 |
|ATMOSPHERE                                                       PUMPED |
|PS3                                                              P2DN   |
|   1:002                                                            B3  |
|----] [---------------------------------------------------------(U)----|
|    05                                                             827  |
B3/827 - -(L)- - File #2 MAIN_PRGRM -  663
       -(U)- - File #2 MAIN_PRGRM -  664
```

```
Rung #665
|MAGNETIC                                                              |
|CHAMBER                                                       SCREEN  |
|=<250                                                         AREA 3  |
|MICRONS                                                       PUMPED  |
|PIR11                                                         P3ON    |
|  I:040                                                          B3   |
|---| |-----------------------------------------------------------(L)--|
|    07                                                           828  |
B3/828 - -(L)- - File #2 MAIN_PRGRM -  665
         -(U)- - File #2 MAIN_PRGRM -  666
Rung #666
|DWELL 3                                                               |
|CHAMBER                                                       SCREEN  |
|PRESSUR AT                                                    AREA 3  |
|ATMOSPHERE                                                    PUMPED  |
|PS4                                                           P3ON    |
|   I:022                                                         B3   |
|---| |-----------------------------------------------------------(U)--|
|    04                                                           828  |
B3/828 - -(L)- - File #2 MAIN_PRGRM -  665
         -(U)- - File #2 MAIN_PRGRM -  666
Rung #667
|CARBON                                                               |
|CHAMBER                                                       SCREEN  |
|=<250                                                         AREA 4  |
  :RONS                                                        PUMPED  |
|PIR16                                                         P4ON    |
|  I:054                                                          B3   |
|---| |-----------------------------------------------------------(L)--|
|    07                                                           829  |
B3/829 - -(L)- - File #2 MAIN_PRGRM -  667
         -(U)- - File #2 MAIN_PRGRM -  668
Rung #668
|DWELL 5                                                               |
|CHAMBER                                                       SCREEN  |
|PRESSUR AT                                                    AREA 4  |
|ATMOSPHERE                                                    PUMPED  |
|PS5                                                           P4ON    |
|   I:036                                                         B3   |
|---| |-----------------------------------------------------------(U)--|
|    04                                                           829  |
B3/829 - -(L)- - File #2 MAIN_PRGRM -  667
         -(U)- - File #2 MAIN_PRGRM -  668
Rung #669
|EXIT BUFFER                                                           |
|CHAMBER                                                       SCREEN  |
|=<250                                                         AREA 5  |
  :RONS                                                        PUMPED  |
|PIR15                                                         P5ON    |
|    I:040                                                        B3   |
|----| |----------------------------------------------------------(L)--|
|     13                                                           830 |
B3/830 - -(L)- - File #2 MAIN_PRGRM -  669
         -(U)- - File #2 MAIN_PRGRM -  670
Rung #670
|EXLOCK                                                                |
|CHAMBER                                                       SCREEN  |
|PRESSUR AT                                                    AREA 5  |
|ATMOSPHERE                                                    PUMPED  |
|PS6                                                           P5ON    |
|   I:052                                                         B3   |
|---| |-----------------------------------------------------------(U)--|
>                                                                      >
```

```
<
|    04                                                                                              830  |
B3/830 - -(L)- - File #2 MAIN_PRGRM -  669
         -(U)- - File #2 MAIN_PRGRM -  670
```

Rung #671

```
|MECHANICAL                                                                                               |
|PUMP 2                                                                                                   |
|TC=<50                                                                                   LINE PRESSURE   |
|MICRONS                                                                                  MADE-TC10       |
|PIR10                                                                                    LPM-TC10        |
|  I:024                                                                                        B3        |
|---] [-------------------------------------------------------------------------------------------(L)------|
|   13                                                                                          250       |
B3/250 - -] [- - File #3 CRYO_REGEN -  15,164,165,166,167,168,169,170,171,172,173,174
                 File #6 TECH_RUNGS -  15
         -(L)- - File #2 MAIN_PRGRM -  671
         -(U)- - File #2 MAIN_PRGRM -  673
```

Rung #672

```
|MECHANICAL                                                                                               |
|PUMP 2                                                                                                   |
|TC=<50                                                                          TC10 FAULT               |
|MICRONS                                                                         DELAY TIMER              |
|PIR10                                                                           TC10FDT                  |
|  I:024                                                                         +--TON----------+        |
|---]/[--------------------------------------------------------------------------+TIMER ON DELAY +-(EN)--|
|   13                                                                           |TIMER:    T4:70|        |
                                                                                 |BASE (SEC): 1.0+-(DN)  |
| T4:70.DN - -] [- - File #2 MAIN_PRGRM - 673                                    |PRESET:     60|        |
|                                                                                |ACCUM:      60|        |
|                                                                                +---------------+        |
```

Rung #673

```
|TC10                                                                                     LINE PRESSURE   |
|TIMEOUT                                                                                  MADE-TC10       |
|TC10FDT                                                                                  LPM-TC10        |
| T4:70                                                                                         B3        |
|---] [-------------------------------------------------------------------------------------------(U)------|
|   DN                                                                                          250       |
|[672]                                                                                                    |
B3/250 - -] [- - File #3 CRYO_REGEN -  15,164,165,166,167,168,169,170,171,172,173,174
                 File #6 TECH_RUNGS -  15
         -(L)- - File #2 MAIN_PRGRM -  671
         -(U)- - File #2 MAIN_PRGRM -  673
```

Rung #674

```
|                                                        LLOCK                                            |
|VENT         AUTO                         PUMP-VENT             CHAMBER                                  |
|LOAD LOCK    MODE                         CYCLE LOAD  PUMPDOWN  PRESSUR AT                 VENT          |
|PUSHBUTTON   ENABLE                       LOCK        LOADLOCK  ATMOSPHERE                 LOAD LOCK     |
|VNTLLPB      AUTO                         PD-VNT-LL   PDLL      PS2                        VNT_LL        |
|  N7:3        N7:37                          N7:24      N7:24     I:002                      N7:24       |
|---] [-------+--]/[--------------+-----------]/[--------]/[-------]/[--------------------------(L)-------|
|   13        |   11              |           14         15        04                           13       |
|[3]          |[158]              |          [676]      [684]                                            |
|             |PALLET    PALLET   |                                                                      |
|             |DETECTED  DETECTED |                                                                      |
|             |CENTER    RIGHT SIDE                                                                      |
|             |LOADLOCK  LOADLOCK |                                                                      |
|             |SEN5      SEN6     |                                                                      |
|             |  I:003     I:003  |                                                                      |
|             +--]/[-------]/[----+                                                                      |
|                 04         05                                                                          |
N7:24/13 - -] [- - File #2 MAIN_PRGRM -  166,173,202,675
           -]/[- - File #2 MAIN_PRGRM -  676,684
```

```
         -(L)- - File #2 MAIN_PRGRM -  674
         -(U)- - File #2 MAIN_PRGRM -  675
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #675
|             LLOCK        OPEN                                                      |
|             CHAMBER      LOAD LOCK                                                 |
| VENT        PRESSUR AT   CHAMBER                                      VENT         |
| LOAD LOCK   ATMOSPHERE   VENT VALVE                                   LOAD LOCK    |
| VNT_LL      PS2          CV1                                          VNT_LL       |
|   N7:24      I:002        O:007                                         N7:24      |
|-+---] [------] [----------]/[-----+-------------------------------------(U)--------|
| |    13       04           16     |                                     13         |
| |[675]                    [177]   |                                                |
| |                                 | N7:24/13 - ] [ - File #2 MAIN_PRGRM - 166, 173, 202, 675
| |                                 |            ]/[ - File #2 MAIN_PRGRM - 676, 684
| |                                 |            -(L)- File #2 MAIN_PRGRM - 674
| |                                 | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
| |PUMPDOWN                         |                                                |
| |LOADLOCK                         |                                                |
| |PDLL                             |                                                |
| |  N7:24                          |                                                |
| |---] [---------------------------|                                                |
| |   15                            |                                                |
| |[684]                            |                                                |
| |PAUSE                            |                                                |
| |DISABLE                          |                                                |
|  TS12                             |                                                |
| |  N7:16                          |                                                |
| +---] [---------------------------+                                                |
|      4                                                                             |
| [3]                                                                                |
Rung #676
|VENT-PUMP                                        LLOCK                              |
|CYCLE LOAD   AUTO                                CHAMBER                PUMP-VENT   |
|LOCK         MODE            VENT       PUMPDOWN PRESSUR AT             CYCLE LOAD  |
|PUSHBUTTON   ENABLE          LOAD LOCK  LOADLOCK ATMOSPHERE             LOCK        |
|V-P-LLPB     AUTO            VNT_LL     PDLL     PS2                    PD-VNT-LL   |
|   N7:3       N7:37           N7:24      N7:24    I:002                   N7:24     |
|----] [------+--]/[--------+---]/[-------]/[------] [---------------------(L)-------|
|     14      |   11        |    13        15       04                      14       |
|[3]          |[158]        | [675]      [684]                                       |
|             |PALLET    PALLET     |                                                |
|             |DETECTED  DETECTED   |                                                |
|             |CENTER    RIGHT SIDE |                                                |
|             |LOADLOCK  LOADLOCK   |                                                |
|             |SENS      SEN6       |                                                |
|             |  I:003     I:003    |                                                |
|             +---]/[------]/[------+                                                |
                  04        05
N7:24/14 - ] [ - File #2 MAIN_PRGRM -  68,166,181,677,678,679,680,681,682
           ]/[ - File #2 MAIN_PRGRM -  674,683,684
          -(L)- - File #2 MAIN_PRGRM -  676
          -(U)- - File #2 MAIN_PRGRM -  677
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #677
| PUMP-VENT                                                          PUMP-VENT   |
| CYCLE LOAD  DOOR 1                                                 CYCLE LOAD  |
| LOCK        OPEN                                                   LOCK        |
| PD-VNT-LL   DROP1S                                                 PD-VNT-LL   |
|    N7:24     I:006                                                   N7:24     |
|-+---] [--------] [---+--------------------------------------------------(U)----|
| |    14          01  |                                                   14    |
| |[677]               |                                                         |
| |                    | N7:24/14 - ] [ - File #2 MAIN_PRGRM - 68, 166, 181, 677, 678, 679, 680, 681, 682
| |                    |            ]/[ - File #2 MAIN_PRGRM - 674, 683, 684
| |                    |            -(L)- - File #2 MAIN_PRGRM - 676
| |                    | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |PAUSE               |                                                         |
| |DISABLE             |                                                         |
| |TS12                |                                                         |
| | N7:16              |                                                         |
| +---] [--------------+                                                         |
|      4                                                                         |
| [3]                                                                            |
Rung #678
|                                              LLOCK       VENT                  |
|PUMP-VENT                                     CHAMBER     LOADLOCK   PUMPDOWN   |
|CYCLE LOAD  DOOR 1   DOOR 2   THREE CYCLES   PRESSUR AT  CLEAN      LOADLOCK   |
|LOCK        CLOSED   CLOSED   COMPLETE       ATMOSPHERE  CYCLE      CLEAN      |
|PD-VNT-LL   DRCL1S   DRCL2S   LL-CCC         PS2         VNT-LL-CC  CYCLE      |
|  N7:24     I:006    I:006        C5:9       I:002         B3       PD-LL-CC   |
|---] [--------] [------] [---------]/[---------] [----------]/[-----------(L)----|
|    14         00       02          DN         04          145          144     |
|[677]                            [682]                   [680]                  |
B3/144 - ] [ - File #2 MAIN_PRGRM -  167,202
         ]/[ - File #2 MAIN_PRGRM -  167
         -(L)- - File #2 MAIN_PRGRM -  678
         -(U)- - File #2 MAIN_PRGRM -  679
Rung #679
|                                                                   PUMPDOWN     |
| PUMP-VENT   LOAD LOCK                                             LOADLOCK     |
| CYCLE LOAD  CHAMBER =<250                                         CLEAN        |
| LOCK        MICRONS                                               CYCLE        |
| PD-VNT-LL   PIR1                                                  PD-LL-CC     |
|    N7:24       I:004                                                 B3        |
|-+---] [----------] [---+------------------------------------------------(U)----|
| |    14            07  |                                                 144   |
| |[677]                 |                                                       |
| |                      | B3/144 - ] [ - File #2 MAIN_PRGRM - 167, 202
| |                      |          ]/[ - File #2 MAIN_PRGRM - 167
| |                      |          -(L)- - File #2 MAIN_PRGRM - 678
| |PAUSE                 |                                                       |
| `ISABLE                |                                                       |
| ,S12                   |                                                       |
| | N7:16                |                                                       |
| +---] [----------------+                                                       |
|      4                                                                         |
| [3]                                                                            |
```

```
Rung #680
|                                  LLOCK                                                              VENT       |
|PUMP-VENT    LOAD LOCK           CHAMBER                                                             LOADLOCK   |
|CYCLE LOAD   CHAMBER =<250       PRESSUR AT   THREE CYCLES                                           CLEAN      |
|LOCK         MICRONS             ATMOSPHERE   COMPLETE                                               CYCLE      |
|PD-VNT-LL    PIR1                PS2          LL-CCC                                                 VNT-LL-CC  |
|  N7:24          I:004          I:002          C5:9                                                  B3         |
|----] [-----------]/[-------------]/[------------]/[-------------------------------------------------(L)--------|
|     14            07             04             DN                                                  145        |
|[677]                                        [682]                                                              |
B3/145 - -] [- - File #2 MAIN_PRGRM -  173
         -]/[- - File #2 MAIN_PRGRM -  678,682
         -(L)- - File #2 MAIN_PRGRM -  680
         -(U)- - File #2 MAIN_PRGRM -  681
Rung #681
|                  OPEN          LLOCK                                                                VENT       |
|  PUMP-VENT    LOAD LOCK     CHAMBER                                                                 LOADLOCK   |
|  CYCLE LOAD   CHAMBER       PRESSUR AT                                                              CLEAN      |
|  LOCK         VENT VALVE    ATMOSPHERE                                                              CYCLE      |
|  PD-VNT-LL    CV1           PS2                                                                     VNT-LL-CC  |
|    N7:24         O:007         I:002                                                                B3         |
|-+----] [-----------]/[-----------] [---+------------------------------------------------------------(U)--------|
| |      14            16            04  |                                                            145        |
| |[677]          [177]                  |                                                                       |
| |                                      | B3/145 - -] [- - File #2 MAIN_PRGRM - 173                             |
| |                                      |          -]/[- - File #2 MAIN_PRGRM - 678, 682                        |
| |                                      |          -(L)- - File #2 MAIN_PRGRM - 680                             |
| |PAUSE                                 |                                                                       |
| |DISABLE                               |                                                                       |
| |TS12                                  |                                                                       |
| |  N7:16                               |                                                                       |
| +----] [-------------------------------+                                                                       |
|       4                                                                                                        |
|  [3]                                                                                                           |
Rung #682
|             VENT          LLOCK                                                                                |
|PUMP-VENT    LOADLOCK      CHAMBER                                                 LOAD LOCK                    |
|CYCLE LOAD   CLEAN         PRESSUR AT                                              CLEAN CYCLE                  |
|LOCK         CYCLE         ATMOSPHERE                                              COUNTER                      |
|PD-VNT-LL    VNT-LL-CC     PS2                                                     LL-CCC                       |
|  N7:24          B3          I:002                                                 +-CTU----------+             |
|----] [-----------]/[----------] [-------------------------------------------------+COUNT UP      +-(CU)-------|
|     14           145          04                                                  |COUNTER:  C5:9|             |
|[677]        [681]                                                                 |PRESET:      4+-(DN)       |
|                                                                                   |ACCUM:       0|             |
|                                                                                   +--------------+             |
C5:9 - CTU - File #2 MAIN_PRGRM -  682
       RES - File #2 MAIN_PRGRM -  683
 :9.DN - -] [- - File #2 MAIN_PRGRM -  181
         -]/[- - File #2 MAIN_PRGRM -  678,680
```

```
Rung #683
| PUMP-VENT
| CYCLE LOAD  DOOR 1                                                          LOAD LOCK
| LOCK        OPEN                                                            CLEAN CYCLE
| PD-VNT-LL   DROP1S                                                          COUNTER
|   N7:24      I:006                                                          LL-CCC
|--+--|/|-------| |--+---------------------------------------------------------CS:9
|  |   14        01  |                                                        -[RES]-
|  |[677]            |
|  |                 | CS:9 - CTU - File #2 MAIN_PRGRM - 682
|  |                 | CS:9.DN - -| |- - File #2 MAIN_PRGRM - 181
|  |                 |           -|/|- - File #2 MAIN_PRGRM - 678, 680
|  |PAUSE            |
|  |DISABLE          |
|  |TS12             |
|  |  N7:16          |
|  +---| |-----------+
|       4
|  [3]
Rung #684
| PUMP DOWN      AUTO
| LOAD LOCK      MODE                   LOAD LOCK      PIRANI              PUMP-VENT   LOAD LOCK
| PUSH BUTTON    ENABLE       DOOR 2    CHAMBER =<250  GUAGE 1   VENT      CYCLE LOAD  CHAMBER =<250  PUMPDOWN
| PDLLPB         AUTO         CLOSED    MICRONS        NO FAULT  LOAD LOCK LOCK        MICRONS        LOADLOCK
|   N7:3          N7:37       DRCL2S    PIR1           PGNF1     VNT_LL    PD-VNT-LL   PIR1           PDLL
|                              I:006     I:004          I:004    N7:24      N7:24      I:004          N7:24
|--+--| |--+--+--|/|-------+---| |------|/|------------| |-------|/|--------|/|--------|/|------------(L)--
|  |   15  |  |   11       |   02        07             14        13         14         07             15
|  |[3]    |  |[158]       |                                    [675]      [677]
|  |       |  |PALLET    PALLET
|  |       |  |DETECTED  DETECTED
|  |VENT AREA |CENTER    RIGHT SIDE
|  |1 ENABLE  |LOADLOCK  LOADLOCK
|  |VENT1E    |SEN5      SEN6
|  |  N7:37   |  I:003     I:003   |
|  +---| |---+  +--|/|-------|/|---+
|       6          04         05
| [410]
N7:24/15 - -| |- - File #2 MAIN_PRGRM -  68,167,675,685,686
          -|/|- - File #2 MAIN_PRGRM -  167,674,676
          -(L)- - File #2 MAIN_PRGRM -  684
          -(U)- - File #2 MAIN_PRGRM -  687
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #685
|PUMPDOWN
|LOADLOCK                                                     ROUGH VALVE 1
|PDLL                                                         OPEN DELAY
| N7:24                                                       RV1OP_DLY
|--| |--------------------------------------------------------+-TON-----------------+
|   15                                                        |TIMER ON DELAY       |-(EN)-
|[684]                                                        |TIMER:        T4:189 |
|                                                             |BASE (SEC):      1.0 |-(DN)
|                                                             |PRESET:            5 |
|                                                             |ACCUM:             0 |
T4:189.DN - -| |- - File #2 MAIN_PRGRM -  167                 +---------------------+
```

Rung #491

```
MANUAL
CONTROL
CRYO GATE                                              MANUAL CRYO
10 OPEN                                                GATE 10 OPEN
M-HV10-1                                               MCG10OP
  N7:4                                                    N7:25
--] [----------------------------------------------------+--(L)--+
  14                                                     |   14   |
[3]                                                      |        |
N7:25/14 - -] [- - File #2 MAIN_PRGRM - 133, 134, 494    |        |
          -(U)- - File #2 MAIN_PRGRM - 492               |MANUAL CRYO
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2              |GATE 10 CLOSE
N7:27/5 - -(L)- - File #2 MAIN_PRGRM - 492               |MCG10CL
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2              |   N7:27
                                                         +--(U)--+
                                                             5
```

Rung #492

```
  MANUAL
  CONTROL
  CRYO GATE                                            MANUAL CRYO
  10 CLOSE                                             GATE 10 OPEN
  M-HV10-0                                             MCG10OP
    N7:6                                                  N7:25
+---] [---+-----------------------------------------+--(U)--+
|     5   |                                         |   14   |
|[3]      |                                         |        |
|         | N7:25/14 - -] [- - File #2 MAIN_PRGRM - 133, 134, 494
|         |            -(L)- - File #2 MAIN_PRGRM - 491      |
|MANUAL   | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2  |MANUAL CRYO
|CONTROL  | N7:27/5 - -(U)- - File #2 MAIN_PRGRM - 491   |GATE 10 CLOSE
|CRYO GATE| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2  |MCG10CL
|10THROTTLE|                                        |   N7:27
|M-HV10-2 |                                         +--(L)--+
|  N7:5   |                                             5
+---] [---+
|    9    |
|[3]      |
|PREPARE FOR
|AUTO RUN |
|>AUTO    |
|  N7:37  |
+---] [---+
|    1    |
|[162]    |
|COMPRESSOR
|7 REGEN- |
|ERATION  |
|PROGRAM  |
 CYRGN7   |
|   B3    |
+---] [---+
    327
 [3:57]
```

```
Rung #493
|MANUAL
|CONTROL                                                                      MANUAL CRYO |
|CRYO GATE                                                                    GATE 10     |
|10THROTTLE                                                                   THROTTLE    |
|M-HV10-2                                                                     MCG10TL     |
|   N7:5                                                                        N7:26     |
|---] [----------------------------------------------------------------------------(L)----|
|    9                                                                            9       |
|[3]                                                                                      |
N7:26/9 - ] [ - - File #2 MAIN_PRGRM -  134,134
         -(L)- - File #2 MAIN_PRGRM -  493
         -(U)- - File #2 MAIN_PRGRM -  494
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #494
| MANUAL                                                                                  |
| CONTROL                                                                     MANUAL CRYO |
| CRYO GATE                                                                   GATE 10     |
| 10 CLOSE                                                                    THROTTLE    |
| M-HV10-0                                                                    MCG10TL     |
|    N7:6                                                                       N7:26     |
|-+----] [-----+--------------------------------------------------------------------(U)---|
| |     5      |                                                                   9      |
| |[3]         |                                                                          |
| |            | N7:26/9 - ] [ - - File #2 MAIN_PRGRM - 134                               |
| |            |          -(L)- - File #2 MAIN_PRGRM - 493                                |
| |            | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                              |
|  MANUAL CRYO |                                                                          |
| |GATE 10 OPEN|                                                                          |
| |MCG10OP     |                                                                          |
| |    N7:25   |                                                                          |
| +----] [-----+                                                                          |
| |     14     |                                                                          |
| |[492]       |                                                                          |
| |PREPARE FOR |                                                                          |
| |AUTO RUN    |                                                                          |
| |>AUTO       |                                                                          |
| |    N7:37   |                                                                          |
| +----] [-----+                                                                          |
| |     1      |                                                                          |
| |[162]       |                                                                          |
| |COMPRESSOR  |                                                                          |
| |7 REGEN-    |                                                                          |
| |ERATION     |                                                                          |
| |PROGRAM     |                                                                          |
| |CYRGN7      |                                                                          |
| |    B3      |                                                                          |
| +----] [-----+                                                                          |
|      327                                                                                |
   [3:57]                                                                                 |
```

420

```
Rung #495
|MANUAL                                                                     |
|CONTROL                                                                    |
|CRYO GATE                                                   MANUAL CRYO    |
|11 OPEN                                                     GATE 11 OPEN   |
|M-HV11-1                                                    MCG11OP        |
|  N7:4                                                         N7:25       |
|---| |------------------------------------------------------+----(L)----+---|
|   15                                                      |     15    |   |
|[3]                                                        |           |   |
| N7:25/15 - -| |- - File #2 MAIN_PRGRM - 135, 136, 498      |           |   |
|             -(U)- - File #2 MAIN_PRGRM - 496              |MANUAL CRYO|   |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2               |GATE 11 CLOSE  |
| N7:27/6 - -(L)- - File #2 MAIN_PRGRM - 496                |MCG11CL    |   |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2               |    N7:27  |   |
|                                                           +----(U)----+   |
|                                                                  6        |
Rung #496
| MANUAL                                                                    |
| CONTROL                                                                   |
| CRYO GATE                                                  MANUAL CRYO    |
| 11 CLOSE                                                   GATE 11 OPEN   |
| M-HV11-0                                                   MCG11OP        |
|    N7:6                                                       N7:25       |
|-+---| |--+-------------------------------------------------+----(U)----+---|
| |    6   |                                                 |     15    |   |
| |[3]     |                                                 |           |   |
|          | N7:25/15 - -| |- - File #2 MAIN_PRGRM - 135, 136, 498       |   |
| |        |             -(L)- - File #2 MAIN_PRGRM - 495    |           |   |
| |MANUAL  | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2     |MANUAL CRYO|   |
| |CONTROL | N7:27/6 - -(U)- - File #2 MAIN_PRGRM - 495      |GATE 11 CLOSE  |
| |CRYO GATE | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2   |MCG11CL    |   |
| |11THROTTLE|                                               |    N7:27  |   |
| |M-HV11-2  |                                               +----(L)----+   |
| |   N7:5   |                                                     6         |
| +---| |----+                                                             |
| |    10    |                                                             |
| |[3]       |                                                             |
| |PREPARE FOR                                                             |
| |AUTO RUN  |                                                             |
| |>AUTO     |                                                             |
| |   N7:37  |                                                             |
| +---| |----+                                                             |
| |    1     |                                                             |
| |[162]     |                                                             |
| |COMPRESSOR|                                                             |
| |8 REGEN-  |                                                             |
| |ERATION   |                                                             |
| |PROGRAM   |                                                             |
| |CYRGN8    |                                                             |
| |    B3    |                                                             |
| +---| |----+                                                             |
|     328                                                                   |
|  [3:63]                                                                   |
```

421

Rung #497

```
|MANUAL
|CONTROL                                                          MANUAL CRYO |
|CRYO GATE                                                        GATE 11     |
|11THROTTLE                                                       THROTTLE    |
|M-HV11-2                                                         MCG11TL     |
|    N7:5                                                            N7:26    |
|---] [-------------------------------------------------------------(L)------|
|    10                                                              10       |
|[3]                                                                          |
N7:26/10 - ] [ - File #2 MAIN_PRGRM -  136,136
          -(L)- - File #2 MAIN_PRGRM -  497
          -(U)- - File #2 MAIN_PRGRM -  498
_F:N7:21%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #498

```
| MANUAL                                                                      |
| CONTROL                                                         MANUAL CRYO |
| CRYO GATE                                                       GATE 11     |
| 11 CLOSE                                                        THROTTLE    |
| M-HV11-0                                                        MCG11TL     |
|    N7:6                                                            N7:26    |
|-+---] [------+----------------------------------------------------(U)------|
| |     6      |                                                     10       |
| |[3]         |                                                              |
| |            | N7:26/10 - ] [ - File #2 MAIN_PRGRM - 136                    |
| |            |           -(L)- - File #2 MAIN_PRGRM - 497                   |
| |            | _F:N7:21%21 - BTW - File #2 MAIN_PRGRM - 2                   |
| MANUAL CRYO  |                                                              |
| |GATE 11 OPEN|                                                              |
| |MCG11OP     |                                                              |
| |   N7:25    |                                                              |
| |----] [-----|                                                              |
| |     15     |                                                              |
| |[496]       |                                                              |
| |PREPARE FOR |                                                              |
| |AUTO RUN    |                                                              |
| |>AUTO       |                                                              |
| |   N7:37    |                                                              |
| |----] [-----|                                                              |
| |     1      |                                                              |
| |[162]       |                                                              |
| |COMPRESSOR  |                                                              |
| |8 REGEN-    |                                                              |
| |ERATION     |                                                              |
| |PROGRAM     |                                                              |
| |CYRGN8      |                                                              |
| |    B3      |                                                              |
| +----] [-----+                                                              |
|     328                                                                     |
   [3:63]                                                                     |
```

```
Rung #499
|MANUAL
|CONTROL
|CRYO GATE                                                                  MANUAL CRYO
|12 OPEN                                                                    GATE 12 OPEN
|M-HV12-1                                                                   MCG12OP
|  N7:5                                                                        N7:26
|---] [-----------------------------------------------------------------+-----(L)-----+-|
|    0                                                                   |       0     | |
|[3]                                                                     |             | |
| N7:26/0 - ] [ - File #2 MAIN_PRGRM - 137, 138, 502                     |             | |
|          -(U)- - File #2 MAIN_PRGRM - 500                              |MANUAL CRYO  | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                            |GATE 12 CLOSE| |
| N7:27/7 - -(L)- - File #2 MAIN_PRGRM - 500                             |MCG12CL      | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                            |     N7:27   | |
|                                                                        +-----(U)-----+ |
|                                                                               7         |
Rung #500
| MANUAL
| CONTROL
| CRYO GATE                                                                 MANUAL CRYO
| 12 CLOSE                                                                  GATE 12 OPEN
| M-HV12-0                                                                  MCG12OP
|    N7:6                                                                      N7:26
|-+----] [----+---------------------------------------------------------+-----(U)-----+-|
| |     7     |                                                          |      0      | |
| |[3]        |                                                          |             | |
|             | N7:26/0 - ] [ - File #2 MAIN_PRGRM - 137, 138, 502       |             | |
| |           |           -(L)- - File #2 MAIN_PRGRM - 499               |             | |
| |MANUAL     | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                |MANUAL CRYO  | |
| |CONTROL    | N7:27/7 - -(U)- - File #2 MAIN_PRGRM - 499                 |GATE 12 CLOSE| |
| |CRYO GATE  | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                |MCG12CL      | |
| |12THROTTLE |                                                          |     N7:27   | |
| |M-HV12-2   |                                                          +-----(L)-----+ |
| |   N7:5    |                                                                 7        |
| +----] [----+                                                                          |
| |     11    |                                                                          |
| |[3]        |                                                                          |
| |PREPARE FOR|                                                                          |
| |AUTO RUN   |                                                                          |
| |>AUTO      |                                                                          |
| |   N7:37   |                                                                          |
| +----] [----+                                                                          |
| |     1     |                                                                          |
| |[162]      |                                                                          |
| |COMPRESSOR |                                                                          |
| |7 REGEN-   |                                                                          |
| |ERATION    |                                                                          |
| |PROGRAM    |                                                                          |
|  :YRGN7     |                                                                          |
| |   B3      |                                                                          |
| +----] [----+                                                                          |
|     327                                                                                |
|  [3:57]                                                                                |
```

```
Rung #501
|MANUAL                                                                                   |
|CONTROL                                                                   MANUAL CRYO    |
|CRYO GATE                                                                 GATE 12        |
|12THROTTLE                                                                THROTTLE       |
|M-HV12-2                                                                  MCG12TL        |
|   N7:5                                                                      N7:26       |
|---] [----------------------------------------------------------------------(L)----------|
|    11                                                                         11        |
|[3]                                                                                      |
N7:26/11 - ] [ - File #2 MAIN_PRGRM -  138,138
           -(L)- - File #2 MAIN_PRGRM -  501
           -(U)- - File #2 MAIN_PRGRM -  502
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #502
| MANUAL                                                                                  |
| CONTROL                                                                  MANUAL CRYO    |
| CRYO GATE                                                                GATE 12        |
| 12 CLOSE                                                                 THROTTLE       |
| M-HV12-0                                                                 MCG12TL        |
|    N7:6                                                                     N7:26       |
|-+----] [-----+-------------------------------------------------------------(U)----------|
| |     7      |                                                                11        |
| |[3]         |                                                                          |
| |            | N7:26/11 - ] [ - File #2 MAIN_PRGRM - 138                                |
| |            |            -(L)- - File #2 MAIN_PRGRM - 501                              |
| |            | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                              |
| |MANUAL CRYO |                                                                          |
| |GATE 12 OPEN|                                                                          |
| |MCG12OP     |                                                                          |
| |   N7:26    |                                                                          |
| |----] [-----|                                                                          |
| |     0      |                                                                          |
| |[500]       |                                                                          |
| |PREPARE FOR |                                                                          |
| |AUTO RUN    |                                                                          |
| |>AUTO       |                                                                          |
| |   N7:37    |                                                                          |
| |----] [-----|                                                                          |
| |     1      |                                                                          |
| |[162]       |                                                                          |
| |COMPRESSOR  |                                                                          |
| |7 REGEN-    |                                                                          |
| |ERATION     |                                                                          |
| |PROGRAM     |                                                                          |
| |CYRGN7      |                                                                          |
| |    B3      |                                                                          |
| +----] [-----+                                                                          |
|     327                                                                                 |
  [3:57]                                                                                  |
```

```
Rung #503
|MANUAL CONTROL                                                             MANUAL ROUGH      |
|ROUGH PUMP                                                                 PUMP VALVE        |
|VALVE 1 OPEN                                                               1 OPEN            |
|M-RV1-1                                                                    MRPV1OP           |
|     N7:7                                                                     N7:28          |
|-----| |--------------------------------------------------------------------+---(L)---+------|
|      0                                                                    |     0   |      |
|[3]                                                                        |         |      |
| N7:28/0 - -| |- - File #2 MAIN_PRGRM - 167                                |MANUAL ROUGH     |
|           -(U)- - File #2 MAIN_PRGRM - 508                                |PUMP VALVE |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |1 CLOSE    |     |
| N7:33/3 - -(L)- - File #2 MAIN_PRGRM - 508                                |MRPV1CL    |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |   N7:33   |     |
|                                                                           +----(U)---+      |
|                                                                                  3          |
Rung #504
|MANUAL CONTROL                                                             MANUAL ROUGH      |
|ROUGH PUMP                                                                 PUMP VALVE        |
|VALVE 2 OPEN                                                               2 OPEN            |
|M-RV2-1                                                                    MRPV2OP           |
|     N7:7                                                                     N7:28          |
|-----| |--------------------------------------------------------------------+---(L)---+------|
|      1                                                                    |     1   |      |
|[3]                                                                        |         |      |
| N7:28/1 - -| |- - File #2 MAIN_PRGRM - 56                                 |MANUAL ROUGH     |
|           -(U)- - File #2 MAIN_PRGRM - 509                                |PUMP VALVE |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |2 CLOSE    |     |
| N7:33/4 - -(L)- - File #2 MAIN_PRGRM - 509                                |MRPV2CL    |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |   N7:33   |     |
|                                                                           +----(U)---+      |
|                                                                                  4          |
Rung #505
|MANUAL CONTROL                                                             MANUAL ROUGH      |
|ROUGH PUMP                                                                 PUMP VALVE        |
|VALVE 3 OPEN                                                               3 OPEN            |
|M-RV3-1                                                                    MRPV3OP           |
|     N7:7                                                                     N7:28          |
|-----| |--------------------------------------------------------------------+---(L)---+------|
|      2                                                                    |     2   |      |
|[3]                                                                        |         |      |
| N7:28/2 - -| |- - File #2 MAIN_PRGRM - 57                                 |MANUAL ROUGH     |
|           -(U)- - File #2 MAIN_PRGRM - 510                                |PUMP VALVE |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |3 CLOSE    |     |
| N7:33/5 - -(L)- - File #2 MAIN_PRGRM - 510                                |MRPV3CL    |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |   N7:33   |     |
|                                                                           +----(U)---+      |
|                                                                                  5          |
Rung #506
|MANUAL CONTROL                                                             MANUAL ROUGH      |
|ROUGH PUMP                                                                 PUMP VALVE        |
|VALVE 4 OPEN                                                               4 OPEN            |
|M-RV4-1                                                                    MRPV4OP           |
|     N7:7                                                                     N7:28          |
|-----| |--------------------------------------------------------------------+---(L)---+------|
|      3                                                                    |     3   |      |
|[3]                                                                        |         |      |
| N7:28/3 - -| |- - File #2 MAIN_PRGRM - 58                                 |MANUAL ROUGH     |
|           -(U)- - File #2 MAIN_PRGRM - 511                                |PUMP VALVE |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |4 CLOSE    |     |
| N7:33/6 - -(L)- - File #2 MAIN_PRGRM - 511                                |MRPV4CL    |     |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                               |   N7:33   |     |
|                                                                           +----(U)---+      |
>                                                                                             >
```

425

```
Rung #507
MANUAL CONTROL                                          6
ROUGH PUMP                                              MANUAL ROUGH
VALVE 5 OPEN                                            PUMP VALVE
M-RV5-1                                                 5 OPEN
                                                        MRVP5OP
   N7:7                                                   N7:28
---] [------------------------------------------------------(L)---
   4                                                        4
[3]
 N7:28/4 - ] [ - File #2 MAIN_PRGRM - 340               MANUAL ROUGH
          -(U)- - File #2 MAIN_PRGRM - 512              PUMP VALVE
 _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2            5 CLOSE
 N7:33/7 - -(L)- - File #2 MAIN_PRGRM - 512             MRPV5CL
 _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              N7:33
                                                          -(U)-
                                                            7

Rung #508
 MANUAL
 CONTROL
 ROUGH PUMP                                             MANUAL ROUGH
 1 VALVE                                                PUMP VALVE
 CLOSE                                                  1 OPEN
 M-RV1-0                                                MRPV1OP
   N7:12                                                  N7:28
---] [------------------------------------------------------(U)---
   3                                                        0
 [3]
            N7:28/0 - ] [ - File #2 MAIN_PRGRM - 167
                     -(L)- - File #2 MAIN_PRGRM - 503   MANUAL ROUGH
            _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2 PUMP VALVE
            N7:33/3 - -(U)- - File #2 MAIN_PRGRM - 503  1 CLOSE
 PREPARE FOR _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2 MRPV1CL
 AUTO RUN                                                 N7:33
 >AUTO                                                    -(L)-
   N7:37                                                    3
 --] [--
   1
 [162]

Rung #509
 MANUAL
 CONTROL
 ROUGH PUMP                                             MANUAL ROUGH
 2  VALVE                                               PUMP VALVE
 CLOSE                                                  2 OPEN
 M-RV2-0                                                MRPV2OP
   N7:12                                                  N7:28
---] [------------------------------------------------------(U)---
   4                                                        1
 [3]
            N7:28/1 - ] [ - File #2 MAIN_PRGRM - 56
                     -(L)- - File #2 MAIN_PRGRM - 504   MANUAL ROUGH
            _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2 PUMP VALVE
            N7:33/4 - -(U)- - File #2 MAIN_PRGRM - 504  2 CLOSE
 PREPARE FOR _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2 MRPV2CL
 AUTO RUN                                                 N7:33
 >AUTO                                                    -(L)-
   N7:37                                                    4
 --] [--
   1
 [162]
```

Rung #510

```
| MANUAL
| CONTROL
| ROUGH PUMP                                                                   MANUAL ROUGH
| 3  VALVE                                                                     PUMP VALVE
| CLOSE                                                                        3 OPEN
| M-RV3-0                                                                      MRPV3OP
|    N7:12                                                                        N7:28
|----| |---+------------------------------------------------------------+--------(U)-------+
|   | 5    |                                                            |          2       |
|   |[3]   |                                                            |                  |
|   |      | N7:28/2 - -| |- - File #2 MAIN_PRGRM - 57                  |                  |
|   |      |           -(L)- - File #2 MAIN_PRGRM - 505                 |MANUAL ROUGH      |
|   |      | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                |PUMP VALVE        |
|   |      | N7:33/5 - -(U)- - File #2 MAIN_PRGRM - 505                 |3 CLOSE           |
|   |PREPARE FOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2          |MRPV3CL           |
|   |AUTO RUN    |                                                      |   N7:33          |
|   |>AUTO       |                                                      +--------(L)-------+
|   |   N7:37    |                                                               5
|   +----| |-----+
|         1
| [162]
```

Rung #511

```
| MANUAL
| CONTROL
| ROUGH PUMP                                                                   MANUAL ROUGH
| 4  VALVE                                                                     PUMP VALVE
| CLOSE                                                                        4 OPEN
| M-RV4-0                                                                      MRPV4OP
|    N7:12                                                                        N7:28
|----| |---+------------------------------------------------------------+--------(U)-------+
|   | 6    |                                                            |          3       |
|   |[3]   |                                                            |                  |
|   |      | N7:28/3 - -| |- - File #2 MAIN_PRGRM - 58                  |                  |
|   |      |           -(L)- - File #2 MAIN_PRGRM - 506                 |MANUAL ROUGH      |
|   |      | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                |PUMP VALVE        |
|   |      | N7:33/6 - -(U)- - File #2 MAIN_PRGRM - 506                 |4 CLOSE           |
|   |PREPARE FOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2          |MRPV4CL           |
|   |AUTO RUN    |                                                      |   N7:33          |
|   |>AUTO       |                                                      +--------(L)-------+
|   |   N7:37    |                                                               6
|   +----| |-----+
|         1
| [162]
```

Rung #512

```
| MANUAL
| CONTROL
| ROUGH PUMP                                        MANUAL ROUGH
| 5  VALVE                                          PUMP VALVE
| CLOSE                                             5 OPEN
| M-RV5-0                                           MRVP5OP
|   N7:12                                             N7:28
|-+---] [---+---------------------------------------+---(U)---+-
| |    7    |                                       |    4    |
| |[3]      |                                       |         |
| |         | N7:28/4 - ] [ - File #2 MAIN_PRGRM - 340
| |         |        -(L)- - File #2 MAIN_PRGRM - 507  |MANUAL ROUGH
| |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 |PUMP VALVE
| |         | N7:33/7 - -(U)- - File #2 MAIN_PRGRM - 507  |5 CLOSE
| |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 |MRPV5CL
| |AUTO RUN |                                       |  N7:33  |
| |>AUTO    |                                       +---(L)---+
| |  N7:37  |                                            7
| +---] [---+
|      1
| [162]
```

Rung #513

```
|MANUAL
|CONTROL
|MOTOR 3                                            MANUAL MOTOR
|ON                                                 3 ON
|M-MCON3                                            MM3ON
  N7:2                                                N7:23
|---] [----------------------------------------------(L)---|
|    1                                                  1
|[3]
N7:23/1 - ] [ - - File #2 MAIN_PRGRM -  185,187
        ]/[ - - File #2 MAIN_PRGRM -  532
        -(L)- - File #2 MAIN_PRGRM -  513
        -(U)- - File #2 MAIN_PRGRM -  551
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #514

```
|MANUAL
|CONTROL
|MOTOR 4                                            MANUAL MOTOR
|ON                                                 4 ON
|M-MCON4                                            MM4ON
| N7:2                                                N7:23
|---] [----------------------------------------------(L)---|
|    2                                                  2
|[3]
N7:23/2 - ] [ - - File #2 MAIN_PRGRM -  190,192
        ]/[ - - File #2 MAIN_PRGRM -  533
        -(L)- - File #2 MAIN_PRGRM -  514
        -(U)- - File #2 MAIN_PRGRM -  552
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #515

```
|MANUAL
|CONTROL
|MOTOR 5                                            MANUAL MOTOR
|ON                                                 5 ON
|M-MCON5                                            MM5ON
| N7:2                                                N7:23
|---] [----------------------------------------------(L)---|
|    3                                                  3
|[3]
```

```
N7:23/3 - -| |- - File #2 MAIN_PRGRM -  195,197
          -|/|- - File #2 MAIN_PRGRM -  534
          -(L)- - File #2 MAIN_PRGRM -  515
          -(U)- - File #2 MAIN_PRGRM -  553
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #516
|MANUAL                                                        |
|CONTROL                                                       |
|MOTOR 6                                         MANUAL MOTOR  |
|ON                                              6 ON          |
|M-MCON6                                         MM6ON         |
|  N7:2                                             N7:23      |
|---] [------------------------------------------------(L)-----|
|    4                                                4        |
|[3]
N7:23/4 - -| |- - File #2 MAIN_PRGRM -  218,220
          -|/|- - File #2 MAIN_PRGRM -  535
          -(L)- - File #2 MAIN_PRGRM -  516
          -(U)- - File #2 MAIN_PRGRM -  554
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #517
|MANUAL                                                        |
|CONTROL                                                       |
|MOTOR 7                                         MANUAL MOTOR  |
|ON                                              7 ON          |
|M-MCON7                                         MM7ON         |
|  N7:2                                             N7:23      |
|---] [------------------------------------------------(L)-----|
|    5                                                5        |
|[3]
N7:23/5 - -| |- - File #2 MAIN_PRGRM -  231,233
          -|/|- - File #2 MAIN_PRGRM -  536
          -(L)- - File #2 MAIN_PRGRM -  517
          -(U)- - File #2 MAIN_PRGRM -  555
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #518
|MANUAL                                                        |
|CONTROL                                                       |
|MOTOR 8                                         MANUAL MOTOR  |
|ON                                              8 ON          |
|M-MCON8                                         MM8ON         |
|  N7:2                                             N7:23      |
|---] [------------------------------------------------(L)-----|
|    6                                                6        |
|[3]
N7:23/6 - -| |- - File #2 MAIN_PRGRM -  249
          -|/|- - File #2 MAIN_PRGRM -  537
          -(L)- - File #2 MAIN_PRGRM -  518
          -(U)- - File #2 MAIN_PRGRM -  556
F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #519
|MANUAL                                                        |
|CONTROL                                                       |
|MOTOR 9                                         MANUAL MOTOR  |
|ON                                              9 ON          |
|M-MCON9                                         MM9ON         |
|  N7:2                                             N7:23      |
|---] [------------------------------------------------(L)-----|
|    7                                                7        |
|[3]
N7:23/7 - -| |- - File #2 MAIN_PRGRM -  253,255
          -|/|- - File #2 MAIN_PRGRM -  538
```

```
        -(L)- - File #2 MAIN_PRGRM -  519
        -(U)- - File #2 MAIN_PRGRM -  557
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
Rung #520
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 10                                              MANUAL MOTOR  |
|ON                                                    10 ON         |
|M-MCON10                                              MM10ON        |
|  N7:2                                                   N7:23      |
|--| |-------------------------------------------------------(L)-----|
|   8                                                        8       |
|[3]                                                                 |
N7:23/8 - -| |- - File #2 MAIN_PRGRM -  258,260
        -|/|- - File #2 MAIN_PRGRM -  539
        -(L)- - File #2 MAIN_PRGRM -  520
        -(U)- - File #2 MAIN_PRGRM -  558
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
Rung #521
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 11                                              MANUAL MOTOR  |
|ON                                                    11 ON         |
|M-MCON11                                              MM11ON        |
|  N7:2                                                   N7:23      |
|--| |-------------------------------------------------------(L)-----|
|   9                                                        9       |
 ^]                                                                  |
.:23/9 - -| |- - File #2 MAIN_PRGRM -  263,265
        -|/|- - File #2 MAIN_PRGRM -  540
        -(L)- - File #2 MAIN_PRGRM -  521
        -(U)- - File #2 MAIN_PRGRM -  559
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
Rung #522
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 12                                              MANUAL MOTOR  |
|ON                                                    12 ON         |
|M-MCON12                                              MM12ON        |
|  N7:2                                                   N7:23      |
|--| |-------------------------------------------------------(L)-----|
|   10                                                       10      |
|[3]                                                                 |
N7:23/10 - -| |- - File #2 MAIN_PRGRM -  281
        -|/|- - File #2 MAIN_PRGRM -  541
        -(L)- - File #2 MAIN_PRGRM -  522
        -(U)- - File #2 MAIN_PRGRM -  560
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
Rung #523
 \NUAL                                                               |
.-ONTROL                                                             |
|MOTOR 13                                              MANUAL MOTOR  |
|ON                                                    13 ON         |
|M-MCON13                                              MM13ON        |
|  N7:2                                                   N7:23      |
|--| |-------------------------------------------------------(L)-----|
|   11                                                       11      |
|[3]                                                                 |
N7:23/11 - -| |- - File #2 MAIN_PRGRM -  285,287
        -|/|- - File #2 MAIN_PRGRM -  542
        -(L)- - File #2 MAIN_PRGRM -  523
        -(U)- - File #2 MAIN_PRGRM -  561
```

```
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #524
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 14                                          MANUAL MOTOR      |
|ON                                                14 ON             |
|M-MCON14                                          MM14ON            |
|  N7:2                                              N7:23           |
|--] [----------------------------------------------------(L)--------|
|   12                                                   12          |
|[3]                                                                 |
N7:23/12 - -] [- - File #2 MAIN_PRGRM -  290,292
           -]/[- - File #2 MAIN_PRGRM -  543
           -(L)- - File #2 MAIN_PRGRM -  524
           -(U)- - File #2 MAIN_PRGRM -  562
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #525
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 15                                          MANUAL MOTOR      |
|ON                                                15 ON             |
|M-MCON15                                          MM15ON            |
|  N7:2                                              N7:23           |
|--] [----------------------------------------------------(L)--------|
|   13                                                   13          |
|[3]                                                                 |
N7:23/13 - -] [- - File #2 MAIN_PRGRM -  295,297
           -]/[- - File #2 MAIN_PRGRM -  544
           -(L)- - File #2 MAIN_PRGRM -  525
           -(U)- - File #2 MAIN_PRGRM -  563
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #526
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 16                                          MANUAL MOTOR      |
|ON                                                16 ON             |
|M-MCON16                                          MM16ON            |
|  N7:2                                              N7:23           |
|--] [----------------------------------------------------(L)--------|
|   14                                                   14          |
|[3]                                                                 |
N7:23/14 - -] [- - File #2 MAIN_PRGRM -  306
           -]/[- - File #2 MAIN_PRGRM -  545
           -(L)- - File #2 MAIN_PRGRM -  526
           -(U)- - File #2 MAIN_PRGRM -  564
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #527
|MANUAL                                                              |
|CONTROL                                                             |
 OTOR 17                                           MANUAL MOTOR      |
                                                   17 ON             |
|M-MCON17                                          MM17ON            |
|  N7:2                                              N7:23           |
|--] [----------------------------------------------------(L)--------|
|   15                                                   15          |
|[3]                                                                 |
N7:23/15 - -] [- - File #2 MAIN_PRGRM -  310,312
           -]/[- - File #2 MAIN_PRGRM -  546
           -(L)- - File #2 MAIN_PRGRM -  527
           -(U)- - File #2 MAIN_PRGRM -  565
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #528
|MANUAL                                                                          |
|CONTROL                                                                         |
|MOTOR 18                                                         MANUAL MOTOR   |
|ON                                                               18 ON          |
|M-MCON18                                                         MM18ON         |
|  N7:3                                                             N7:24        |
|--| |---------------------------------------------------------------(L)---------|
|   0                                                                 0          |
|[3]                                                                             |
N7:24/0 - -| |- - File #2 MAIN_PRGRM -  315,317
          -|/|- - File #2 MAIN_PRGRM -  547
          -(L)- - File #2 MAIN_PRGRM -  528
          -(U)- - File #2 MAIN_PRGRM -  566
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #529
|MANUAL                                                                          |
|CONTROL                                                                         |
|MOTOR 19                                                         MANUAL MOTOR   |
|ON                                                               19 ON          |
|M-MCON19                                                         MM19ON         |
|  N7:3                                                             N7:24        |
|--| |---------------------------------------------------------------(L)---------|
|   1                                                                 1          |
|[3]                                                                             |
N7:24/1 - -| |- - File #2 MAIN_PRGRM -  320,322
          -|/|- - File #2 MAIN_PRGRM -  548
          -(L)- - File #2 MAIN_PRGRM -  529
          -(U)- - File #2 MAIN_PRGRM -  567
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #530
|MANUAL                                                                          |
|CONTROL                                                                         |
|MOTOR 20                                                         MANUAL MOTOR   |
|ON                                                               20 ON          |
|M-MCON20                                                         MM20ON         |
|  N7:3                                                             N7:24        |
|--| |---------------------------------------------------------------(L)---------|
|   2                                                                 2          |
|[3]                                                                             |
N7:24/2 - -| |- - File #2 MAIN_PRGRM -  331,333
          -|/|- - File #2 MAIN_PRGRM -  549,550
          -(L)- - File #2 MAIN_PRGRM -  530
          -(U)- - File #2 MAIN_PRGRM -  568
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #531
|MANUAL                                                                          |
|CONTROL                                                                         |
|MOTOR 21                                                         MANUAL MOTOR   |
  N                                                               21 ON          |
  MCON21                                                          MM21ON         |
|  N7:3                                                             N7:24        |
|--| |---------------------------------------------------------------(L)---------|
|   3                                                                 3          |
|[3]                                                                             |
N7:24/3 - -| |- - File #2 MAIN_PRGRM -  355,357
          -(L)- - File #2 MAIN_PRGRM -  531
          -(U)- - File #2 MAIN_PRGRM -  569
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #532
|MANUAL MOTOR                                              MANUAL MOTOR |
|3 ON                                                      3 OFF        |
|MM3ON                                                     MM3OFF       |
|   N7:23                                                     N7:21     |
|----|/|---------------------------------------------------------( )----|
|     1                                                          3      |
|[513]                                                                  |
N7:21 - BTW - File #2 MAIN_PRGRM - 2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
Rung #533
|MANUAL MOTOR                                              MANUAL MOTOR |
|4 ON                                                      4 OFF        |
|MM4ON                                                     MM4OFF       |
|   N7:23                                                     N7:21     |
|----|/|---------------------------------------------------------( )----|
|     2                                                          4      |
|[514]                                                                  |
N7:21 - BTW - File #2 MAIN_PRGRM - 2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
Rung #534
|MANUAL MOTOR                                              MANUAL MOTOR |
|5 ON                                                      5 OFF        |
|MM5ON                                                     MM5OFF       |
|   N7:23                                                     N7:21     |
|----|/|---------------------------------------------------------( )----|
|     3                                                          5      |
 515]                                                                   |
  :21 - BTW - File #2 MAIN_PRGRM - 2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
Rung #535
|MANUAL MOTOR                                              MANUAL MOTOR |
|6 ON                                                      6 OFF        |
|MM6ON                                                     MM6OFF       |
|   N7:23                                                     N7:21     |
|----|/|---------------------------------------------------------( )----|
|     4                                                          6      |
|[516]                                                                  |
N7:21 - BTW - File #2 MAIN_PRGRM - 2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
Rung #536
|MANUAL MOTOR                                              MANUAL MOTOR |
|7 ON                                                      7 OFF        |
|MM7ON                                                     MM7OFF       |
|   N7:23                                                     N7:21     |
|----|/|---------------------------------------------------------( )----|
|     5                                                          7      |
|[517]                                                                  |
N7:21 - BTW - File #2 MAIN_PRGRM - 2
 :N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
 ung #537
|MANUAL MOTOR                                              MANUAL MOTOR |
|8 ON                                                      8 OFF        |
|MM8ON                                                     MM8OFF       |
|   N7:23                                                     N7:21     |
|----|/|---------------------------------------------------------( )----|
|     6                                                          8      |
|[518]                                                                  |
N7:21 - BTW - File #2 MAIN_PRGRM - 2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
```

```
Rung #538
|MANUAL MOTOR                                                    MANUAL MOTOR |
|9 ON                                                            9 OFF        |
|MM9ON                                                           MM9OFF       |
|    N7:23                                                          N7:21     |
|----]/[----------------------------------------------------------( )--------|
|     7                                                               9       |
|[519]                                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #539
|MANUAL MOTOR                                                    MANUAL MOTOR |
|10 ON                                                           10 OFF       |
|MM10ON                                                          MM10OFF      |
|    N7:23                                                          N7:21     |
|----]/[----------------------------------------------------------( )--------|
|     8                                                               10      |
|[520]                                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #540
|MANUAL MOTOR                                                    MANUAL MOTOR |
|11 ON                                                           11 OFF       |
|MM11ON                                                          MM11OFF      |
|    N7:23                                                          N7:21     |
|----]/[----------------------------------------------------------( )--------|
|     9                                                               11      |
 '521]                                                                        |
..:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #541
|MANUAL MOTOR                                                    MANUAL MOTOR |
|12 ON                                                           12 OFF       |
|MM12ON                                                          MM12OFF      |
|    N7:23                                                          N7:21     |
|----]/[----------------------------------------------------------( )--------|
|     10                                                              12      |
|[522]                                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #542
|MANUAL MOTOR                                                    MANUAL MOTOR |
|13 ON                                                           13 OFF       |
|MM13ON                                                          MM13OFF      |
|    N7:23                                                          N7:21     |
|----]/[----------------------------------------------------------( )--------|
|     11                                                              13      |
|[523]                                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
 ~:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
.ung #543
|MANUAL MOTOR                                                    MANUAL MOTOR |
|14 ON                                                           14 OFF       |
|MM14ON                                                          MM14OFF      |
|    N7:23                                                          N7:21     |
|----]/[----------------------------------------------------------( )--------|
|     12                                                              14      |
|[524]                                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #544
|MANUAL MOTOR                                                        MANUAL MOTOR |
|15 ON                                                               15 OFF       |
|MM15ON                                                              MM15OFF      |
|    N7:23                                                              N7:21     |
|----] / [-------------------------------------------------------------( )-------|
|      13                                                                15       |
|[525]                                                                            |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #545
|MANUAL MOTOR                                                        MANUAL MOTOR |
|16 ON                                                               16 OFF       |
|MM16ON                                                              MM16OFF      |
|    N7:23                                                              N7:22     |
|----] / [-------------------------------------------------------------( )-------|
|      14                                                                0        |
|[526]                                                                            |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #546
|MANUAL MOTOR                                                        MANUAL MOTOR |
|17 ON                                                               17 OFF       |
|MM17ON                                                              MM17OFF      |
|    N7:23                                                              N7:22     |
|----] / [-------------------------------------------------------------( )-------|
|      15                                                                1        |
|[527]                                                                            |
_ "7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
. .ig #547
|MANUAL MOTOR                                                        MANUAL MOTOR |
|18 ON                                                               18 OFF       |
|MM18ON                                                              MM18OFF      |
|    N7:24                                                              N7:22     |
|----] / [-------------------------------------------------------------( )-------|
|      0                                                                 2        |
|[528]                                                                            |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #548
|MANUAL MOTOR                                                        MANUAL MOTOR |
|19 ON                                                               19 OFF       |
|MM19ON                                                              MM19OFF      |
|    N7:24                                                              N7:22     |
|----] / [-------------------------------------------------------------( )-------|
|      1                                                                 3        |
|[529]                                                                            |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #549
|MANUAL MOTOR                                                        MANUAL MOTOR |
|20 ON                                                               20 OFF       |
|' "OON                                                              MM20OFF      |
|    N7:24                                                              N7:22     |
|----] / [-------------------------------------------------------------( )-------|
|      2                                                                 4        |
|[530]                                                                            |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #550
|MANUAL MOTOR                                                        MANUAL MOTOR |
|20 ON                                                               21 OFF       |
|MM20ON                                                              MM21OFF      |
|    N7:24                                                              N7:22     |
|----] / [-------------------------------------------------------------( )-------|
|      2                                                                 5        |
|[568]                                                                            |
```

435

```
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #551
| MANUAL                                                                       |
| CONTROL                                                                      |
| MOTOR 3                                                        MANUAL MOTOR  |
| OFF                                                            3 ON          |
| M-MCOF3                                                        MM3ON         |
|   N7:0                                                            N7:23      |
|---] [------------------------------------------------------------(U)--------|
| |   3       |                                                       1        |
| |[3]        |                                                                |
| |           | N7:23/1 - ] [ - File #2 MAIN_PRGRM - 185, 187                    |
| |           |           ]/[ - File #2 MAIN_PRGRM - 532                         |
| |           |           -(L)- - File #2 MAIN_PRGRM - 513                       |
| |           | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |
| |PREPARE FOR|                                                                |
| |AUTO RUN   |                                                                |
| |>AUTO      |                                                                |
| |   N7:37   |                                                                |
| |----] [----|                                                                |
|       1                                                                      |
| [162]                                                                        |
Rung #552
| MANUAL                                                                       |
| CONTROL                                                                      |
| MOTOR 4                                                        MANUAL MOTOR  |
| OFF                                                            4 ON          |
  M-MCOF4                                                        MM4ON         |
   N7:0                                                             N7:23      |
|---] [------------------------------------------------------------(U)--------|
| |   4       |                                                       2        |
| |[3]        |                                                                |
| |           | N7:23/2 - ] [ - File #2 MAIN_PRGRM - 190, 192                    |
| |           |           ]/[ - File #2 MAIN_PRGRM - 533                         |
| |           |           -(L)- - File #2 MAIN_PRGRM - 514                       |
| |           | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |
| |PREPARE FOR|                                                                |
| |AUTO RUN   |                                                                |
| |>AUTO      |                                                                |
| |   N7:37   |                                                                |
| |----] [----|                                                                |
|       1                                                                      |
| [162]                                                                        |
```

```
Rung #553
| MANUAL
| CONTROL                                                                          MANUAL MOTOR
| MOTOR 5                                                                          5 ON
| OFF                                                                              MM5ON
| M-MCOF5                                                                            N7:23
|  N7:0                                                                          ---(U)---
|---| |-----------------------------------------------------------------------------  3
| |  5     |
| |[3]     | N7:23/3 - -| |- - File #2 MAIN_PRGRM - 195, 197
| |        |           -|/|- - File #2 MAIN_PRGRM - 534
| |        |           -(L)- - File #2 MAIN_PRGRM - 515
| |        | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |   N7:37    |
| |-----| |----|
|         1
| [162]
Rung #554
| MANUAL
| CONTROL                                                                          MANUAL MOTOR
| MOTOR 6                                                                          6 ON
| OFF                                                                              MM6ON
| M-MCOF6                                                                            N7:23
|  N7:0                                                                          ---(U)---
|---| |-----------------------------------------------------------------------------  4
| |  6     |
| |[3]     | N7:23/4 - -| |- - File #2 MAIN_PRGRM - 218, 220
| |        |           -|/|- - File #2 MAIN_PRGRM - 535
| |        |           -(L)- - File #2 MAIN_PRGRM - 516
| |        | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |   N7:37    |
| |-----| |----|
|         1
| [162]
Rung #555
| MANUAL
| CONTROL                                                                          MANUAL MOTOR
| MOTOR 7                                                                          7 ON
| OFF                                                                              MM7ON
| M-MCOF7                                                                            N7:23
|  N7:0                                                                          ---(U)---
|---| |-----------------------------------------------------------------------------  5
| |  7     |
| |[3]     | N7:23/5 - -| |- - File #2 MAIN_PRGRM - 231, 233
| |        |           -|/|- - File #2 MAIN_PRGRM - 536
| |        |           -(L)- - File #2 MAIN_PRGRM - 517
| |        | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |   N7:37    |
| |-----| |----|
|         1
| [162]
```

```
Rung #556
| MANUAL                                                                           |
| CONTROL                                                                          |
| MOTOR 8                                                          MANUAL MOTOR   |
| OFF                                                              8 ON           |
| M-MCOF8                                                          MM8ON          |
|   N7:0                                                              N7:23       |
|--+--] [--+------------------------------------------------------------(U)-------|
|  |   8   |                                                             6        |
|  |[3]    |                                                                      |
|  |       | N7:23/6 - ] [ - File #2 MAIN_PRGRM - 249                             |
|  |       |           ]/[ - File #2 MAIN_PRGRM - 537                             |
|  |       |           -(L)- - File #2 MAIN_PRGRM - 518                           |
|  |       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                          |
|  |PREPARE FOR                                                                   |
|  |AUTO RUN                                                                      |
|  |>AUTO  |                                                                      |
|  |  N7:37|                                                                      |
|  +--] [--+                                                                      |
|      1                                                                           |
| [162]                                                                           |
Rung #557
| MANUAL                                                                           |
| CONTROL                                                                          |
| MOTOR 9                                                          MANUAL MOTOR   |
| OFF                                                              9 ON           |
| M-MCOF9                                                          MM9ON          |
|   N7:0                                                              N7:23       |
|--+--] [--+------------------------------------------------------------(U)-------|
|  |   9   |                                                             7        |
|  |[3]    |                                                                      |
|  |       | N7:23/7 - ] [ - File #2 MAIN_PRGRM - 253, 255                        |
|  |       |           ]/[ - File #2 MAIN_PRGRM - 538                             |
|  |       |           -(L)- - File #2 MAIN_PRGRM - 519                           |
|  |       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                          |
|  |PREPARE FOR                                                                   |
|  |AUTO RUN                                                                      |
|  |>AUTO  |                                                                      |
|  |  N7:37|                                                                      |
|  +--] [--+                                                                      |
|      1                                                                           |
| [162]                                                                           |
Rung #558
| MANUAL                                                                           |
| CONTROL                                                                          |
| MOTOR 10                                                         MANUAL MOTOR   |
| OFF                                                              10 ON          |
| M-MCOF10                                                         MM10ON         |
|   N7:0                                                              N7:23       |
|--+--] [--+------------------------------------------------------------(U)-------|
|  |   10  |                                                             8        |
|  |[3]    |                                                                      |
|  |       | N7:23/8 - ] [ - File #2 MAIN_PRGRM - 258, 260                        |
|  |       |           ]/[ - File #2 MAIN_PRGRM - 539                             |
|  |       |           -(L)- - File #2 MAIN_PRGRM - 520                           |
|  |       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                          |
|  |PREPARE FOR                                                                   |
|  |AUTO RUN                                                                      |
|  |>AUTO  |                                                                      |
|  |  N7:37|                                                                      |
|  +--] [--+                                                                      |
|      1                                                                           |
| [162]                                                                           |
```

```
Rung #559
MANUAL
CONTROL                                                        MANUAL MOTOR
MOTOR 11                                                       11 ON
OFF                                                            MM11ON
M-MCOF11                                                        N7:23
  N7:0
---] [----------------------------------------------------------(U)---
   11                                                             9
[3]
        N7:23/9 - ] [ - File #2 MAIN_PRGRM - 263, 265
                  ]/[ - File #2 MAIN_PRGRM - 540
                  (L) - File #2 MAIN_PRGRM - 521
        _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
PREPARE FOR
AUTO RUN
>AUTO
   N7:37
---] [---
    1
[162]

Rung #560
MANUAL
CONTROL                                                        MANUAL MOTOR
MOTOR 12                                                       12 ON
OFF                                                            MM12ON
M-MCOF12                                                        N7:23
  N7:0
---] [----------------------------------------------------------(U)---
   12                                                             10
[3]
        N7:23/10 - ] [ - File #2 MAIN_PRGRM - 281
                   ]/[ - File #2 MAIN_PRGRM - 541
                   (L) - File #2 MAIN_PRGRM - 522
        _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
PREPARE FOR
AUTO RUN
>AUTO
   N7:37
---] [---
    1
[162]

Rung #561
MANUAL
CONTROL                                                        MANUAL MOTOR
MOTOR 13                                                       13 ON
OFF                                                            MM13ON
M-MCOF13                                                        N7:23
  N7:0
---] [----------------------------------------------------------(U)---
   13                                                             11
[3]
        N7:23/11 - ] [ - File #2 MAIN_PRGRM - 285, 287
                   ]/[ - File #2 MAIN_PRGRM - 542
                   (L) - File #2 MAIN_PRGRM - 523
        _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
PREPARE FOR
AUTO RUN
>AUTO
   N7:37
---] [---
    1
[162]
```

```
Rung #562
| MANUAL
| CONTROL
| MOTOR 14                                                                    MANUAL MOTOR
| OFF                                                                         14 ON
| M-MCOF14                                                                    MM14ON
|    N7:0                                                                        N7:23
|-+---| |----+------------------------------------------------------------------(U)----|
| |    14    |                                                                    12
| | [3]      |
| |          | N7:23/12 - -| |- - File #2 MAIN_PRGRM - 290, 292
| |          |            -|/|- - File #2 MAIN_PRGRM - 543
| |          |            -(L)- - File #2 MAIN_PRGRM - 524
| |          | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR|
| |AUTO RUN  |
| |>AUTO     |
| |   N7:37  |
| +----| |---+
|       1
| [162]
Rung #563
| MANUAL
| CONTROL
| MOTOR 15                                                                    MANUAL MOTOR
| OFF                                                                         15 ON
| M-MCOF15                                                                    MM15ON
|    N7:0                                                                        N7:23
|-+---| |----+------------------------------------------------------------------(U)----|
| |    15    |                                                                    13
| | [3]      |
| |          | N7:23/13 - -| |- - File #2 MAIN_PRGRM - 295, 297
| |          |            -|/|- - File #2 MAIN_PRGRM - 544
| |          |            -(L)- - File #2 MAIN_PRGRM - 525
| |          | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR|
| |AUTO RUN  |
| |>AUTO     |
| |   N7:37  |
| +----| |---+
|       1
| [162]
Rung #564
| MANUAL
| CONTROL
| MOTOR 16                                                                    MANUAL MOTOR
| OFF                                                                         16 ON
| M-MCOF16                                                                    MM16ON
|    N7:1                                                                        N7:23
|-+---| |----+------------------------------------------------------------------(U)----|
| |    0     |                                                                    14
| | [3]      |
| |          | N7:23/14 - -| |- - File #2 MAIN_PRGRM - 306
| |          |            -|/|- - File #2 MAIN_PRGRM - 545
| |          |            -(L)- - File #2 MAIN_PRGRM - 526
| |          | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR|
| |AUTO RUN  |
| |>AUTO     |
| |   N7:37  |
| +----| |---+
|       1
| [162]
```

```
Rung #565
| MANUAL
| CONTROL
| MOTOR 17                                                        MANUAL MOTOR |
| OFF                                                             17 ON        |
| M-MCOF17                                                        MM17ON       |
|   N7:1                                                             N7:23     |
|---] [---------------------------------------------------------------(U)-----|
| |  1    |                                                            15      |
| |[3]    |                                                                    |
| |       | N7:23/15 - ] [ - File #2 MAIN_PRGRM - 310, 312                     |
| |       |            ]/[ - File #2 MAIN_PRGRM - 546                          |
| |       |            -(L)- - File #2 MAIN_PRGRM - 527                        |
| |       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        |
| |PREPARE FOR                                                               |
| |AUTO RUN |                                                                  |
| |>AUTO    |                                                                  |
| |   N7:37 |                                                                  |
| |---] [---|                                                                  |
|      1                                                                       |
| [162]
Rung #566
| MANUAL
| CONTROL
| MOTOR 18                                                        MANUAL MOTOR |
| OFF                                                             18 ON        |
| M-MCOF18                                                        MM18ON       |
|   N7:1                                                             N7:24     |
|---] [---------------------------------------------------------------(U)-----|
| |  2    |                                                            0       |
| |[3]    |                                                                    |
| |       | N7:24/0 - ] [ - File #2 MAIN_PRGRM - 315, 317                      |
| |       |           ]/[ - File #2 MAIN_PRGRM - 547                           |
| |       |           -(L)- - File #2 MAIN_PRGRM - 528                         |
| |       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        |
| |PREPARE FOR                                                               |
| |AUTO RUN |                                                                  |
| |>AUTO    |                                                                  |
| |   N7:37 |                                                                  |
| |---] [---|                                                                  |
|      1                                                                       |
| [162]
Rung #567
| MANUAL
| CONTROL
| MOTOR 19                                                        MANUAL MOTOR |
| OFF                                                             19 ON        |
| M-MCOF19                                                        MM19ON       |
|   N7:1                                                             N7:24     |
|---] [---------------------------------------------------------------(U)-----|
| |  3    |                                                            1       |
| |[3]    |                                                                    |
| |       | N7:24/1 - ] [ - File #2 MAIN_PRGRM - 320, 322                      |
| |       |           ]/[ - File #2 MAIN_PRGRM - 548                           |
| |       |           -(L)- - File #2 MAIN_PRGRM - 529                         |
| |       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        |
| |PREPARE FOR                                                               |
| |AUTO RUN |                                                                  |
| |>AUTO    |                                                                  |
| |   N7:37 |                                                                  |
| |---] [---|                                                                  |
|      1                                                                       |
| [162]
```

Rung #568

```
| MANUAL
| CONTROL
| MOTOR 20                                                   MANUAL MOTOR |
| OFF                                                        20 ON        |
| M-MCOF20                                                   MM20ON       |
|    N7:1                                                      N7:24      |
|-+--] [--+--------------------------------------------------------(U)----|
| |   4     |                                                      2      |
| |[3]      |                                                             |
| |         | N7:24/2 - ] [ - File #2 MAIN_PRGRM - 331, 333               |
| |         |           ]/[ - File #2 MAIN_PRGRM - 549, 550               |
| |         |           -(L)- - File #2 MAIN_PRGRM - 530                  |
| |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |
| |PREPARE FOR|                                                           |
| |AUTO RUN  |                                                            |
| |>AUTO     |                                                            |
| |   N7:37  |                                                            |
| +---] [----+                                                            |
|      1                                                                  |
| [162]                                                                   |
```

Rung #569

```
| MANUAL
| CONTROL
| MOTOR 21                                                   MANUAL MOTOR |
| OFF                                                        21 ON        |
| M-MCOF21                                                   MM21ON       |
|    N7:1                                                      N7:24      |
|-+--] [--+--------------------------------------------------------(U)----|
| |   5     |                                                      3      |
| |[3]      |                                                             |
| |         | N7:24/3 - ] [ - File #2 MAIN_PRGRM - 355, 357               |
| |         |           -(L)- - File #2 MAIN_PRGRM - 531                  |
| |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |
| |PREPARE FOR|                                                           |
| |AUTO RUN  |                                                            |
| |>AUTO     |                                                            |
| |   N7:37  |                                                            |
| +---] [----+                                                            |
|      1                                                                  |
| [162]                                                                   |
```

```
Rung #570
|MOTOR 3                                                                   MOTOR 3     |
|REVERSE                                                                   REVERSE     |
|ENABLE                                                                    M3R         |
|M3RE                                                                        B3        |
|  N7:19                                                                               |
|--| |-------------------------------------------------------------------+---(L)---+---|
|   2                                                                    |   103    |   |
|[3]                                                                     |          |   |
|                                                                        |MANUAL    |   |
| B3/103 - -| |- - File #2 MAIN_PRGRM - 187                              |MOTOR 3   |   |
|          -|/|- - File #2 MAIN_PRGRM - 185                              |REVERSE   |   |
|          -(U)- - File #2 MAIN_PRGRM - 589                              |ENABLE    |   |
| N7:40/2 - -(U)- - File #2 MAIN_PRGRM - 589                             |MM3RE     |   |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                            |  N7:40   |   |
| N7:34/15 - -(L)- - File #2 MAIN_PRGRM - 589                            |---(L)----|   |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                            |    2     |   |
|                                                                        |MANUAL    |   |
|                                                                        |MOTOR 3   |   |
|                                                                        |REVERSE   |   |
|                                                                        |DISABLE   |   |
|                                                                        |MM3RD     |   |
|                                                                        |  N7:34   |   |
|                                                                        +---(U)----+   |
|                                                                            15         |
Rung #571
|MOTOR 4                                                                   MOTOR 4     |
|REVERSE                                                                   REVERSE     |
  ABLE                                                                     M4R         |
|M4RE                                                                        B3        |
|  N7:19                                                                               |
|--| |-------------------------------------------------------------------+---(L)---+---|
|   3                                                                    |   104    |   |
|[3]                                                                     |          |   |
|                                                                        |MANUAL    |   |
| B3/104 - -| |- - File #2 MAIN_PRGRM - 192                              |MOTOR 4   |   |
|          -|/|- - File #2 MAIN_PRGRM - 190                              |REVERSE   |   |
|          -(U)- - File #2 MAIN_PRGRM - 590                              |ENABLE    |   |
| N7:40/3 - -(U)- - File #2 MAIN_PRGRM - 590                             |MM4RE     |   |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                            |  N7:40   |   |
| N7:35/0 - -(L)- - File #2 MAIN_PRGRM - 590                             |---(L)----|   |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                            |    3     |   |
|                                                                        |MANUAL    |   |
|                                                                        |MOTOR 4   |   |
|                                                                        |REVERSE   |   |
|                                                                        |DISABLE   |   |
|                                                                        |MM4RD     |   |
|                                                                        |  N7:35   |   |
|                                                                        +---(U)----+   |
|                                                                             0         |
```

Rung #572

```
|MOTOR 5                                                                   MOTOR 5
|REVERSE                                                                   REVERSE
|ENABLE                                                                    M5R
|M5RE                                                                        B3
|  N7:19
|---] [-------------------------------------------------------------------+--(L)--+
|     4                                                                   |  105  |
|[3]                                                                      |       |
|                                                                         |MANUAL |
| B3/105 - ] [ - File #2 MAIN_PRGRM - 197                                 |MOTOR 5|
|          ]/[ - File #2 MAIN_PRGRM - 195                                 |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 591                               |ENABLE |
| N7:40/4 - -(U)- - File #2 MAIN_PRGRM - 591                              |MM5RE  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             | N7:40 |
| N7:35/1 - -(L)- - File #2 MAIN_PRGRM - 591                              +--(L)--+
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             |   4   |
|                                                                         |MANUAL |
|                                                                         |MOTOR 5|
|                                                                         |REVERSE|
|                                                                         |DISABLE|
|                                                                         |MM5RD  |
|                                                                         | N7:35 |
|                                                                         +--(U)--+
|                                                                             1
```

Rung #573

```
|MOTOR 6                                                                   MOTOR 6
|REVERSE                                                                   REVERSE
|ENABLE                                                                    M6R
|M6RE                                                                        B3
|  N7:19
|---] [-------------------------------------------------------------------+--(L)--+
|     5                                                                   |  106  |
|[3]                                                                      |       |
|                                                                         |MANUAL |
| B3/106 - ] [ - File #2 MAIN_PRGRM - 220                                 |MOTOR 6|
|          ]/[ - File #2 MAIN_PRGRM - 218                                 |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 592                               |ENABLE |
| N7:40/5 - -(U)- - File #2 MAIN_PRGRM - 592                              |MM6RE  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             | N7:40 |
| N7:35/2 - -(L)- - File #2 MAIN_PRGRM - 592                              +--(L)--+
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             |   5   |
|                                                                         |MANUAL |
|                                                                         |MOTOR 6|
|                                                                         |REVERSE|
|                                                                         |DISABLE|
|                                                                         |MM6RD  |
|                                                                         | N7:35 |
|                                                                         +--(U)--+
|                                                                             2
```

Rung #574

```
|MOTOR 7                                                              MOTOR 7
|REVERSE                                                              REVERSE
|ENABLE                                                               M7R
|M7RE                                                                   B3
| N7:19                                                               --(L)--
|--| |------------------------------------------------------------------107
|   6                                                                 |
|[3]                                                                  |MANUAL
|                                                                     |MOTOR 7
| B3/107 - -| |- - File #2 MAIN_PRGRM - 233                           |REVERSE
|          -|/|- - File #2 MAIN_PRGRM - 231                           |ENABLE
|          -(U)- - File #2 MAIN_PRGRM - 593                           |MM7RE
| N7:40/6 - -(U)- - File #2 MAIN_PRGRM - 593                          | N7:40
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |--(L)--
| N7:35/3 - -(L)- - File #2 MAIN_PRGRM - 593                          |   6
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |MANUAL
|                                                                     |MOTOR 7
|                                                                     |REVERSE
|                                                                     |DISABLE
|                                                                     |MM7RD
|                                                                     | N7:35
|                                                                     |--(U)--
                                                                          3
```

Rung #575

```
|MOTOR 8                                                              MOTOR 8
 EVERSE                                                               REVERSE
|ENABLE                                                               M8R
|M8RE                                                                   B3
| N7:19                                                               --(L)--
|--| |------------------------------------------------------------------108
|   7                                                                 |
|[3]                                                                  |MANUAL
|                                                                     |MOTOR 8
| B3/108 - -| |- - File #2 MAIN_PRGRM - 249                           |REVERSE
|          -|/|- - File #2 MAIN_PRGRM - 249                           |ENABLE
|          -(U)- - File #2 MAIN_PRGRM - 594                           |MM8RE
| N7:40/7 - -(U)- - File #2 MAIN_PRGRM - 594                          | N7:40
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |--(L)--
| N7:35/4 - -(L)- - File #2 MAIN_PRGRM - 594                          |   7
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |MANUAL
|                                                                     |MOTOR 8
|                                                                     |REVERSE
|                                                                     |DISABLE
|                                                                     |MM8RD
|                                                                     | N7:35
|                                                                     |--(U)--
                                                                          4
```

```
Rung #576
|MOTOR 9                                                                  MOTOR 9
|REVERSE                                                                  REVERSE
|ENABLE                                                                   M9R
|M9RE                                                                       B3
| N7:19
|--| |--------------------------------------------------------------------+--(L)--+
|   8                                                                    |  109   |
|[3]                                                                     |        |
|                                                                        |MANUAL  |
| B3/109 - -| |- - File #2 MAIN_PRGRM - 255                              |MOTOR 9 |
|          -|/|- - File #2 MAIN_PRGRM - 253                              |REVERSE |
|          -(U)- - File #2 MAIN_PRGRM - 595                              |ENABLE  |
| N7:40/8 - -(U)- - File #2 MAIN_PRGRM - 595                             |MM9RE   |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                            | N7:40  |
| N7:35/5 - -(L)- - File #2 MAIN_PRGRM - 595                             +--(L)---+
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                            |   8    |
|                                                                        |MANUAL  |
|                                                                        |MOTOR 9 |
|                                                                        |REVERSE |
|                                                                        |DISABLE |
|                                                                        |MM9RD   |
|                                                                        | N7:35  |
|                                                                        +--(U)---+
|                                                                            5
Rung #577
|MOTOR 10                                                                 MOTOR 10
|REVERSE                                                                  REVERSE
|ENABLE                                                                   M10R
|M10RE                                                                      B3
| N7:19
|--| |--------------------------------------------------------------------+--(L)--+
|   9                                                                    |  110   |
|[3]                                                                     |        |
|                                                                        |MANUAL  |
| B3/110 - -| |- - File #2 MAIN_PRGRM - 260                              |MOTOR 10|
|          -|/|- - File #2 MAIN_PRGRM - 258                              |REVERSE |
|          -(U)- - File #2 MAIN_PRGRM - 596                              |ENABLE  |
| N7:40/9 - -(U)- - File #2 MAIN_PRGRM - 596                             |MM10RE  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                            | N7:40  |
| N7:35/6 - -(L)- - File #2 MAIN_PRGRM - 596                             +--(L)---+
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                            |   9    |
|                                                                        |MANUAL  |
|                                                                        |MOTOR 10|
|                                                                        |REVERSE |
|                                                                        |DISABLE |
|                                                                        |MM10RD  |
|                                                                        | N7:35  |
|                                                                        +--(L)---+
|                                                                            6
```

```
Rung #578
|MOTOR 11                                                              |
|REVERSE                                                  MOTOR 11     |
|ENABLE                                                   REVERSE      |
|M11RE                                                    M11R         |
| N7:19                                                      B3        |
|--] [---------------------------------------------------+----(L)----+-|
|   10                                                   |    111    | |
|[3]                                                     |           | |
|                                                        |MANUAL     | |
| B3/111 - ] [ - File #2 MAIN_PRGRM - 265                |MOTOR 11   | |
|          ]/[ - File #2 MAIN_PRGRM - 263                |REVERSE    | |
|          -(U)- - File #2 MAIN_PRGRM - 597              |ENABLE     | |
| N7:40/10 - -(U)- - File #2 MAIN_PRGRM - 597            |MM11RE     | |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2            | N7:40     | |
| N7:35/7 - -(L)- - File #2 MAIN_PRGRM - 597             |----(L)----| |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2            |    10     | |
|                                                        |MANUAL     | |
|                                                        |MOTOR 11   | |
|                                                        |REVERSE    | |
|                                                        |DISABLE    | |
|                                                        |MM11RD     | |
|                                                        | N7:35     | |
|                                                        +----(U)----+ |
|                                                             7         |
Rung #579
|MOTOR 12                                                              |
 ``VERSE                                                  MOTOR 12     |
  .ABLE                                                   REVERSE      |
|M12RE                                                    M12R         |
| N7:19                                                      B3        |
|--] [---------------------------------------------------+----(L)----+-|
|   11                                                   |    112    | |
|[3]                                                     |           | |
|                                                        |MANUAL     | |
| B3/112 - ] [ - File #2 MAIN_PRGRM - 281                |MOTOR 12   | |
|          ]/[ - File #2 MAIN_PRGRM - 281                |REVERSE    | |
|          -(U)- - File #2 MAIN_PRGRM - 598              |ENABLE     | |
| N7:40/11 - -(U)- - File #2 MAIN_PRGRM - 598            |MM12RE     | |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2            | N7:40     | |
| N7:35/8 - -(L)- - File #2 MAIN_PRGRM - 598             |----(L)----| |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2            |    11     | |
|                                                        |MANUAL     | |
|                                                        |MOTOR 12   | |
|                                                        |REVERSE    | |
|                                                        |DISABLE    | |
|                                                        |MM12RD     | |
|                                                        | N7:35     | |
|                                                        +----(U)----+ |
|                                                             8         |
```

```
Rung #580
|MOTOR 13                                                       |
|REVERSE                                            MOTOR 13    |
|ENABLE                                             REVERSE     |
|M13RE                                              M13R        |
|  N7:19                                               B3       |
|---| |-------------------------------------------------(L)----|
|    12                                             |  113    | |
|[3]                                                |         | |
|                                                   |MANUAL   | |
| B3/113 - -| |- - File #2 MAIN_PRGRM - 287        |MOTOR 13 | |
|          -|/|- - File #2 MAIN_PRGRM - 285        |REVERSE  | |
|          -(U)- - File #2 MAIN_PRGRM - 599        |ENABLE   | |
| N7:40/12 - -(U)- - File #2 MAIN_PRGRM - 599      |MM13RE   | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2      |  N7:40  | |
| N7:35/9 - -(L)- - File #2 MAIN_PRGRM - 599       |---(L)---| |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2      |   12    | |
|                                                   |MANUAL   | |
|                                                   |MOTOR 13 | |
|                                                   |REVERSE  | |
|                                                   |DISABLE  | |
|                                                   |MM13RD   | |
|                                                   |  N7:35  | |
|                                                   |---(U)---  |
|                                                       9       |
Rung #581
|MOTOR 14                                                       |
 'EVERSE                                            MOTOR 14    |
  ABLE                                              REVERSE     |
|M14RE                                              M14R        |
|  N7:19                                               B3       |
|---| |-------------------------------------------------(L)----|
|    13                                             |  114    | |
|[3]                                                |         | |
|                                                   |MANUAL   | |
| B3/114 - -| |- - File #2 MAIN_PRGRM - 292        |MOTOR 14 | |
|          -|/|- - File #2 MAIN_PRGRM - 290        |REVERSE  | |
|          -(U)- - File #2 MAIN_PRGRM - 600        |ENABLE   | |
| N7:40/13 - -(U)- - File #2 MAIN_PRGRM - 600      |MM14RE   | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2      |  N7:40  | |
| N7:35/10 - -(L)- - File #2 MAIN_PRGRM - 600      |---(L)---| |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2      |   13    | |
|                                                   |MANUAL   | |
|                                                   |MOTOR 14 | |
|                                                   |REVERSE  | |
|                                                   |DISABLE  | |
|                                                   |MM14RD   | |
|                                                   |  N7:35  | |
|                                                   |---(U)---  |
|                                                      10       |
```

```
Rung #692
|                                                        EXLOCK                                    |
|VENT-PUMP                                               CHAMBER                       PUMPDOWN    |
|CYCLE EXIT  DOOR 12   DOOR 11   THREE CYCLES   PRESSUR AT   VENT                     EXIT LOCK   |
|LOCK        CLOSED    CLOSED    COMPLETE       ATMOSPHERE   EXIT LOCK                CLEAN CYCLE |
|VNT-PD-EX   DRCL12S   DRCL11S   EX-CCC         PS6          VNT-EX                   PD-EX-CC    |
|  N7:27      I:056     I:056      C5:11        I:052        B3                          B3       |
|---] [--------] [------] [---------]/[----------] [---------]/[-------------------------(L)------|
|    9          06        04          DN           04          498                        497     |
|[691]                              [696]                    [694]                                |
B3/497 - ] [ - File #2 MAIN_PRGRM - 337,340,367
        -(L)- - File #2 MAIN_PRGRM - 692
        -(U)- - File #2 MAIN_PRGRM - 693
Rung #693
|                EXITLOCK                                                                          |
| VENT-PUMP      CHAMBER                                                               PUMPDOWN    |
| CYCLE EXIT     <250                                                                  EXIT LOCK   |
| LOCK           MICRONS                                                               CLEAN CYCLE |
| VNT-PD-EX      PIR17                                                                 PD-EX-CC    |
|    N7:27        I:054                                                                   B3       |
|-+---] [-----------] [---+----------------------------------------------------------------(U)----|
| |    9            10    |                                                               497      |
| |[691]                  |                                                                        |
| |                       | B3/497 - ] [ - File #2 MAIN_PRGRM - 337, 340, 367                      |
| |                       |         -(L)- - File #2 MAIN_PRGRM - 692                               |
| |PAUSE                  |                                                                        |
| |DISABLE                |                                                                        |
| |TS12                   |                                                                        |
| | N7:16                 |                                                                        |
| +---] [-----------------+                                                                        |
|      4                                                                                           |
| [3]                                                                                              |
Rung #694
|            EXITLOCK  EXLOCK                                                                      |
|VENT-PUMP   CHAMBER   CHAMBER                                                                     |
|CYCLE EXIT  <250      PRESSUR AT  THREE CYCLES                                       VENT        |
|LOCK        MICRONS   ATMOSPHERE  COMPLETE                                           EXIT LOCK   |
|VNT-PD-EX   PIR17     PS6         EX-CCC                                             VNT-EX      |
|  N7:27      I:054     I:052       C5:11                                               B3        |
|---] [--------] [-------]/[---------]/[----------------------------------------------(L)--------|
|    9          10        04          DN                                                498       |
|[691]                             [696]                                                          |
B3/498 - ] [ - File #2 MAIN_PRGRM - 346,367
        ]/[ - File #2 MAIN_PRGRM - 692,696
        -(L)- - File #2 MAIN_PRGRM - 694
        -(U)- - File #2 MAIN_PRGRM - 695
```

```
Rung #689
|                                                                              |
|            EXLOCK      OPEN                                                  |
|            CHAMBER     EXLOCK                                                |
| VENT       PRESSUR AT  CHAMBER                                   VENT        |
| EXIT LOCK  ATMOSPHERE  VENT VALVE                                EXIT LOCK   |
| VNTEX      PS6         CVS                                       VNTEX       |
|    N7:27      I:052       O:057                                  N7:27      |
|-+---] [--------] [---------]/[---+-----------------------------------(U)-----|
| |    8          04          16    |                                 8        |
| |[689]                    [367]   |                                          |
| |                                 | N7:27/8 - ] [ - File #2 MAIN_PRGRM - 337, 339, 346, 689
| |                                 |           ]/[ - File #2 MAIN_PRGRM - 690, 698
| |                                 |           -(L)- - File #2 MAIN_PRGRM - 688
| |PUMP DOWN                        | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |EXIT LOCK                        |                                          |
| |PUSH BUTTON                      |                                          |
| |PDEXPB                           |                                          |
| |    N7:6                         |                                          |
| |----] [--------------------------|                                          |
| |     10                          |                                          |
| |[3]                              |                                          |
| |PAUSE                            |                                          |
| |DISABLE                          |                                          |
| |TS12                             |                                          |
| |   N7:16                         |                                          |
| +---] [---------------------------+                                          |
|      4                                                                       |
   [3]
Rung #690
|VENT-PUMP                              EXLOCK                                 |
|CYCLE EXIT  AUTO                       CHAMBER                  VENT-PUMP     |
|LOCK        MODE    VENT      PUMP DOWN  PRESSUR AT             CYCLE EXIT    |
|PUSHBUTTON  ENABLE  EXIT LOCK EXIT LOCK  ATMOSPHERE             LOCK          |
|V-P-EXPB    AUTO    VNTEX     PDEX       PS6                    VNT-PD-EX     |
|   N7:6     N7:37    N7:27     N7:27      I:052                    N7:27      |
|----] [------]/[------]/[--------]/[--------] [------------------------(L)-----|
|     9        11       8         10         04                         9      |
|[3]        [158]   [689]     [698]                                            |
N7:27/9 - ] [ - File #2 MAIN_PRGRM - 78,339,351,691,692,693,694,695,696
          ]/[ - File #2 MAIN_PRGRM - 688,697,698
          -(L)- - File #2 MAIN_PRGRM - 690
          -(U)- - File #2 MAIN_PRGRM - 691
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
Rung #691
| VENT-PUMP                                                      VENT-PUMP     |
| CYCLE EXIT  DOOR 12                                            CYCLE EXIT    |
| LOCK        OPEN                                               LOCK          |
| VNT-PD-EX   DROP12S                                            VNT-PD-EX     |
|    N7:27       I:056                                              N7:27      |
|-+----] [---------] [----+-----------------------------------------(U)-------|
| |      9          07    |                                           9        |
| |[691]                  |                                                    |
| |                       | N7:27/9 - ] [ - File #2 MAIN_PRGRM - 78, 339, 351, 691, 692, 693, 694, 695, 696
| |                       |           ]/[ - File #2 MAIN_PRGRM - 688, 697, 698
| |                       |           -(L)- - File #2 MAIN_PRGRM - 690
| |                       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PAUSE                  |                                                    |
| |DISABLE                |                                                    |
| |TS12                   |                                                    |
| |   N7:16               |                                                    |
| +---] [-----------------+                                                    |
|      4                                                                       |
|  [3]                                                                         |
```

```
Rung #695
           EXLOCK       OPEN
 VENT-PUMP CHAMBER      EXLOCK
 CYCLE EXIT PRESSUR AT  CHAMBER                                          VENT
 LOCK      ATMOSPHERE   VENT VALVE                                       EXIT LOCK
 VNT-PD-EX PS6          CV5                                              VNT-EX
   N7:27    I:052       O:057                                            B3
---] [-------] [---------]/[----------------------------------------------(U)--
     9        04         16                                              498
 [691]                  [367]
                              B3/498 - ] [ - File #2 MAIN_PRGRM - 346, 367
                                      ]/[ - File #2 MAIN_PRGRM - 692, 696
                                      -(L)- - File #2 MAIN_PRGRM - 694
 PAUSE
 DISABLE
 TS12
   N7:16
---] [---
     4
 [3]

Rung #696
                          EXLOCK
VENT-PUMP                 CHAMBER                              EXIT LOCK
CYCLE EXIT  VENT          PRESSUR AT                           CLEAN CYCLE
LOCK        EXIT LOCK     ATMOSPHERE                           COUNTER
VNT-PD-EX   VNT-EX        PS6                                  EX-CCC
  N7:27       B3          I:052                                +-CTU-----------+
---] [--------]/[---------] [----------------------------------|COUNT UP       |-(CU)-
     9        498          04                                  |COUNTER:  C5:11|
[691]        [695]                                             |PRESET:       4|-(DN)
                                                               |ACCUM:        0|
                                                               +---------------+
C5:11 - CTU - File #2 MAIN_PRGRM - 696
        RES - File #2 MAIN_PRGRM - 697
C5:11.DN - ] [ - File #2 MAIN_PRGRM - 351
          ]/[ - File #2 MAIN_PRGRM - 692,694

Rung #697
 VENT-PUMP                                                       EXIT LOCK
 CYCLE EXIT  DOOR 12                                             CLEAN CYCLE
 LOCK        OPEN                                                COUNTER
 VNT-PD-EX   DROP12S                                             EX-CCC
   N7:27      I:056                                              C5:11
---]/[--------] [-------------------------------------------------[RES]---
     9         07
 [691]
                    C5:11 - CTU - File #2 MAIN_PRGRM - 696
                    C5:11.DN - ] [ - File #2 MAIN_PRGRM - 351
                              ]/[ - File #2 MAIN_PRGRM - 692, 694
 PAUSE
 DISABLE
 TS12
   N7:16
---] [---
     4
 [3]
```

451

Rung #698

```
PUMP DOWN     AUTO                    EXITLOCK    PIRINI     VENT        VENT-PUMP    EXITLOCK     PUMP DOWN
EXIT LOCK     MODE      DOOR 11       CHAMBER     GUAGE 8    EXIT LOCK   CYCLE EXIT   CHAMBER      EXIT LOCK
PUSH BUTTON   ENABLE    CLOSED        <250        NO FAULT   VNTEX       LOCK         <250         PDEX
PDEXPB        AUTO      DRCL11S       MICRONS     PGNF8      N7:27       VNT-PD-EX    MICRONS      N7:27
N7:6          N7:37     I:056         PIR17       I:054                  N7:27        PIR17
                                      I:054                                           I:054
--] [--       --]/[--   --] [--       --]/[--     --] [--    --]/[--     --]/[--      --]/[--      --(L)--
  10            11        04            10          15          8          9             10           10
[3]           [158]                                          [689]       [691]
VENT AREA
5 ENABLE
VENTSE
N7:37
--] [--
  10
[433]
```

N7:27/10 -] [- File #2 MAIN_PRGRM - 78,340,699
]/[- File #2 MAIN_PRGRM - 109,688,690
-(L)- - File #2 MAIN_PRGRM - 698
-(U)- - File #2 MAIN_PRGRM - 700
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2

Rung #699

```
              EXITLOCK                                      PUMPDOWN
              CHAMBER                                       EXITLOCK
PUMP DOWN     <250                                          COMPLETE
EXIT LOCK     MICRONS                                       PFEXEND
PDEX          PIR17                                         +--TON-------------+
N7:27         I:054                                         |TIMER ON DELAY    |-(EN)-
--] [--       --] [--                                       |TIMER:     T4:222 |
  10            10                                          |BASE (SEC):   1.0 |-(DN)
[698]                                                       |PRESET:         5 |
              PIRINI                                        |ACCUM:          0 |
              GUAGE 8                                       +------------------+
              NO FAULT
              PGNF8
              I:054
              --]/[--
                15
```

T4:222.DN -] [- File #2 MAIN_PRGRM - 700
T4:222.TT -] [- File #2 MAIN_PRGRM - 98

Rung #700

```
PFEXEND                                                     PUMP DOWN
T4:222                                                      EXIT LOCK
--] [--                                                     PDEX
  DN                                                        N7:27
[699]                                                       --(U)--
PAUSE                                                         10
DISABLE
TS12
N7:16
--] [--
  4
[3]
```

N7:27/10 -] [- File #2 MAIN_PRGRM - 78, 340, 699
]/[- File #2 MAIN_PRGRM - 109, 688, 690
-(L)- - File #2 MAIN_PRGRM - 698
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2

```
Rung #686
|                                                                              PUMPDOWN          |
|              LOAD LOCK                                                       LOADLOCK          |
|PUMPDOWN      CHAMBER =<250                                                   DISABLE           |
|LOADLOCK      MICRONS                                                         PULSE             |
|PDLL          PIR1                                                            PDLLDPLSE         |
| N7:24          I:004                                                        +--TON---------+   |
|---| |------+----| |-----+-------------------------------------------------+TIMER ON DELAY |-(EN)-|
|    15      |     07     |                                                 |TIMER:   T4:287|      |
|[687]       |            |                                                 |BASE (SEC): 1.0|-(DN) |
|            |            | T4:287.DN - -| |- - File #2 MAIN_PRGRM - 687     |PRESET:       5|      |
|            |PIRANI      | T4:287.TT - -| |- - File #2 MAIN_PRGRM - 84      |ACCUM:        0|      |
|            |GUAGE 1     |                                                 +---------------+      |
|            |NO FAULT    |                                                                        |
|            |PGNF1       |                                                                        |
|            |  I:004     |                                                                        |
|            +---|/|------+                                                                        |
|                 14                                                                               |
Rung #687
|                                                                                 PUMPDOWN |
|                                                                                 LOADLOCK |
| PDLLDPLSE                                                                       PDLL     |
|   T4:287                                                                          N7:24  |
|-+----| |------+---------------------------------------------------------------------(U)---|
| |      DN     |                                                                    15    |
| |[686]        |                                                                          |
| |             | N7:24/15 - -| |- - File #2 MAIN_PRGRM - 68, 167, 675, 685, 686           |
| |             |            -|/|- - File #2 MAIN_PRGRM - 167, 674, 676                    |
| |             |            -(L)- - File #2 MAIN_PRGRM - 684                              |
| |             | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                              |
| |PAUSE        |                                                                          |
| |DISABLE      |                                                                          |
| |TS12         |                                                                          |
| |  N7:16      |                                                                          |
| +----| |------+                                                                          |
|       4                                                                                  |
| [3]                                                                                      |
Rung #688
|                                                EXLOCK                                    |
|VENT        AUTO        VENT-PUMP               CHAMBER                                   |
|EXITLOCK    MODE        CYCLE EXIT  PUMP DOWN   PRESSUR AT                    VENT        |
|PUSHBUTTON  ENABLE      LOCK        EXIT LOCK   ATMOSPHERE                    EXIT LOCK   |
|VNTEXPB     AUTO        VNT-PD-EX   PDEX        PS6                           VNTEX       |
|   N7:6      N7:37      N7:27        N7:27       I:052                          N7:27     |
|----| |-------|/|--------|/|----------|/|---------|/|----------------------------(L)------|
|     8         11         9            10          04                            8        |
|[3]         [158]      [690]        [698]                                                 |
N7:27/8 - -| |- - File #2 MAIN_PRGRM -  337,339,346,689
          -|/|- - File #2 MAIN_PRGRM -  690,698
          -(L)- - File #2 MAIN_PRGRM -  688
          -(U)- - File #2 MAIN_PRGRM -  689
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #701
|MANUAL                                                              |
|CONTROL                                               MANUAL        |
|CHAMBER                                               CHAMBER       |
|VENT 1                                                VENT 1        |
|CLOSE                                                 CLOSE         |
|M-CV1-0                                               MCVNT1CL      |
| N7:4                                                  N7:25        |
|--] [------------------------------------------------+--(L)--------|
|  0                                                  |   0      |  |
|[3]                                                  |          |  |
|                                                     |MANUAL    |  |
| N7:25/0 - -(U)- - File #2 MAIN_PRGRM - 706          |CHAMBER   |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |VENT 1    |  |
| N7:27/11 - -(L)- - File #2 MAIN_PRGRM - 706         |OPEN      |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |MCVNT1OP  |  |
|                                                     | N7:27    |  |
|                                                     +--(U)-----+  |
|                                                         11         |
Rung #702
|MANUAL                                                              |
|CONTROL                                               MANUAL        |
|CHAMBER                                               CHAMBER       |
|VENT VALVE                                            VENT 2        |
|CLOSE                                                 CLOSE         |
|M-CV2-0                                               MCVNT2CL      |
|   N7:4                                                N7:25        |
 --] [------------------------------------------------+--(L)--------|
|    1                                                |   1      |  |
|[3]                                                  |          |  |
|                                                     |MANUAL    |  |
| N7:25/1 - -(U)- - File #2 MAIN_PRGRM - 707          |CHAMBER   |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |VENT 2    |  |
| N7:27/12 - -(L)- - File #2 MAIN_PRGRM - 707         |OPEN      |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |MCVNT2OP  |  |
|                                                     | N7:27    |  |
|                                                     +--(U)-----+  |
|                                                         12         |
Rung #703
|MANUAL                                                              |
|CONTROL                                               MANUAL        |
|CHAMBER                                               CHAMBER       |
|VENT VALVE                                            VENT 3        |
|CLOSE                                                 CLOSE         |
|M-CV3-0                                               MCVNT3CL      |
|   N7:4                                                N7:25        |
|----] [----------------------------------------------+--(L)--------|
|    2                                                |   2      |  |
|[3]                                                  |          |  |
|                                                     |MANUAL    |  |
| N7:25/2 - -(U)- - File #2 MAIN_PRGRM - 708          |CHAMBER   |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |VENT 3    |  |
| N7:27/13 - -(L)- - File #2 MAIN_PRGRM - 708         |OPEN      |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |MCVNT3OP  |  |
|                                                     | N7:27    |  |
|                                                     +--(U)-----+  |
|                                                         13         |
```

Rung #704

```
|MANUAL                                                                  MANUAL
|CONTROL                                                                 CHAMBER
|CHAMBER                                                                 VENT 4
|VENT VALVE                                                              CLOSE
|4 CLOSE                                                                 MCVNT4CL
|M-CV4-0                                                                  N7:25
|    N7:4
|----| |--------------------------------------------------------------+----(L)----|
|     3                                                              |     3
|[3]                                                                 |
|                                                                    |MANUAL
| N7:25/3 - -(U)- - File #2 MAIN_PRGRM - 709                         |CHAMBER
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |VENT 4
| N7:27/14 - -(L)- - File #2 MAIN_PRGRM - 709                        |OPEN
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |MCVNT4OP
|                                                                    | N7:27
|                                                                    +----(U)----
|                                                                          14
```

Rung #705

```
|MANUAL                                                                  MANUAL
|CONTROL                                                                 CHAMBER
|CHAMBER                                                                 VENT 5
|VENT VALVE                                                              CLOSE
|5 CLOSE                                                                 MCVNT5CL
|M-CV5-0                                                                  N7:25
|    N7:4
|----| |--------------------------------------------------------------+----(L)----|
|     4                                                              |     4
|[3]                                                                 |
|                                                                    |MANUAL
| N7:25/4 - -(U)- - File #2 MAIN_PRGRM - 710                         |CHAMBER
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |VENT 5
| N7:27/15 - -(L)- - File #2 MAIN_PRGRM - 710                        |OPEN
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |MCVNT5OP
|                                                                    | N7:27
|                                                                    +----(U)----
|                                                                          15
```

Rung #706

```
|MANUAL                                                                  MANUAL
|CONTROL                                                                 CHAMBER
|CHAMBER                                                                 VENT 1
|VENT 1                                                                  OPEN
|OPEN                                                                    MCVNT1OP
|M-CV1-1                                                                  N7:27
|  N7:6
|----| |--------------------------------------------------------------+----(L)----|
|     11                                                             |     11
|[3]                                                                 |
|                                                                    |MANUAL
| N7:27/11 - -(U)- - File #2 MAIN_PRGRM - 701                        |CHAMBER
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |VENT 1
| N7:25/0 - -(L)- - File #2 MAIN_PRGRM - 701                         |CLOSE
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |MCVNT1CL
|                                                                    | N7:25
|                                                                    +----(U)----
|                                                                          0
```

Rung #707

```
|MANUAL
|CONTROL                                                      MANUAL
|CHAMBER                                                      CHAMBER
|VENT 2                                                       VENT 2
|OPEN                                                         OPEN
|M-CV2-1                                                      MCVNT2OP
|  N7:6                                                        N7:27
|--] [-----------------------------------------------------+----(L)----+
|   12                                                     |     12    |
|[3]                                                       |           |
|                                                          |MANUAL     |
| N7:27/12 - -(U)- - File #2 MAIN_PRGRM - 702              |CHAMBER    |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |VENT 2     |
| N7:25/1 - -(L)- - File #2 MAIN_PRGRM - 702               |CLOSE      |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |MCVNT2CL   |
|                                                          | N7:25     |
|                                                          +----(U)----+
|                                                                1
```

Rung #708

```
|MANUAL
|CONTROL                                                      MANUAL
|CHAMBER                                                      CHAMBER
|VENT 3                                                       VENT 3
|OPEN                                                         OPEN
|M-CV3-1                                                      MCVNT3OP
|  N7:6                                                        N7:27
  -] [-----------------------------------------------------+----(L)----+
    13                                                     |     13    |
|[3]                                                       |           |
|                                                          |MANUAL     |
| N7:27/13 - -(U)- - File #2 MAIN_PRGRM - 703              |CHAMBER    |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |VENT 3     |
| N7:25/2 - -(L)- - File #2 MAIN_PRGRM - 703               |CLOSE      |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |MCVNT3CL   |
|                                                          | N7:25     |
|                                                          +----(U)----+
|                                                                2
```

Rung #709

```
|MANUAL
|CONTROL                                                      MANUAL
|CHAMBER                                                      CHAMBER
|VENT 4                                                       VENT 4
|OPEN                                                         OPEN
|M-CV4-1                                                      MCVNT4OP
|  N7:6                                                        N7:27
|--] [-----------------------------------------------------+----(L)----+
|   14                                                     |     14    |
|[3]                                                       |           |
                                                           |MANUAL     |
, N7:27/14 - -(U)- - File #2 MAIN_PRGRM - 704              |CHAMBER    |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |VENT 4     |
| N7:25/3 - -(L)- - File #2 MAIN_PRGRM - 704               |CLOSE      |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |MCVNT4CL   |
|                                                          | N7:25     |
|                                                          +----(U)----+
|                                                                3
```

Rung #710

```
MANUAL CONTROL                                   MANUAL
CHAMBER VENT 5                                   CHAMBER
OPEN                                             VENT 5
M-CVS-1                                          OPEN
                                                 MCVNT5OP
      N7:6                                        N7:27
|----| |-----------------------------------------+--(L)--+
      15                                         |   15  |
[3]                                              |       |
                                                 |MANUAL |
N7:27/15 - -(U)- - File #2 MAIN_PRGRM - 705      |CHAMBER|
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      |VENT 5 |
N7:25/4 - -(L)- - File #2 MAIN_PRGRM - 705       |CLOSE  |
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      |MCVNT5CL
                                                 | N7:25 |
                                                 +--(U)--+
                                                     4
```

Rung #711

```
                       WATER TEST                WATER FLOW
                       LOCK                      SWITCH TEST
   AUTOPULSE           H20_TST_LOK               WFS_TST
    T4:282                B3                        B3
|-+---| |----+-----------| |---------------------(L)---|
  |     TT   |            33                       281
  |[158]     |
  |          | B3/281 - -| |- - File #2 MAIN_PRGRM - 712
  |          |          -(U)- - File #2 MAIN_PRGRM - 713
  | AUOFPULSE|
  |  T4:283  |
  +---| |----+
      DN
 [155]
```

Rung #712

```
WATER FLOW                                WATER FLOW
SWITCH TEST                               SWITCH TIMER
WFS_TST                                   WFS_TMR
    B3                                    +-TON-----------------+
|---| |-----------------------------------|TIMER ON DELAY       |-(EN)-
    281                                   |TIMER:        T4:330 |
[711]                                     |BASE (SEC):   1.0    |-(DN)
                                          |PRESET:         20   |
                                          |ACCUM:           0   |
                                          +---------------------+
T4:330 - TON - File #2 MAIN_PRGRM -  712
         LEQ - File #2 MAIN_PRGRM -  719
T4:330.ACC - LEQ - File #2 MAIN_PRGRM -  717,718,720
             GEQ - File #2 MAIN_PRGRM -  717,718,719,720
T4:330.DN - -| |- - File #2 MAIN_PRGRM -  713
```

ng #713

```
                                                 WATER FLOW
                                                 SWITCH TEST
WFS_TMR                                          WFS_TST
 T4:330                                             B3
|--| |-------------------------------------------(U)---|
   DN                                               281
[712]
B3/281 - -| |- - File #2 MAIN_PRGRM -  712
         -(L)- - File #2 MAIN_PRGRM -  711
         -(U)- - File #2 MAIN_PRGRM -  713
```

Rung #714

```
|CATHODE      CATHODE      CATHODE      CATHODE                   CATHODE      CATHODE      CATHODE      CATHODE      CATHODE
|WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW
|SWITCH 1     SWITCH 1     SWITCH 1     SWITCH 4     SWITCH 5     SWITCH 6     SWITCH 7     SWITCH 8     SWITCH 9     SWITCH 10
|CHR1A        CHR1A        CHR1A        CHR4A        CHR1B        CHR2B        CHR3B        CHR4B        WFS9         WFS10
|  I:026        I:026        I:026        I:026        I:026        I:026        I:026        I:026        I:042        I:042
|---|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---
|   10           10           10           13           14           15           16           17           10           11
                                                                                                  CATHODE      CATHODE                  |
                                                                                                  WATER FLOW   WATER FLOW   FLOW SWITCH |
                                                                                                  SWITCH 11    SWITCH 12    GROUP 1 OK  |
                                                                                                  WFS11        WFS12        FTST1_OK    |
                                                                                                    I:042        I:042        B3        |
                                                                                                  ----|/|----------|/|---------( )------|
                                                                                                      12           13           283     |
```

B3/283 - -| |- - File #2 MAIN_PRGRM - 717
-( )- - File #2 MAIN_PRGRM - 714

Rung #715

```
|CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      CATHODE
|WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW   WATER FLOW
|SWITCH 13    SWITCH 14    SWITCH 15    SWITCH 16    SWITCH 17    SWITCH 18    SWITCH 19    SWITCH 20    SWITCH 21    SWITCH 22
|WFS13        WFS14        WFS15        WFS16        WFS17        WFS18        WFS19        WFS20        WFS21        WFS22
|  I:042        I:042        I:042        I:042        I:056        I:056        I:056        I:056        I:056        I:056
|---|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---
|   14           15           16           17           10           11           12           13           14           15
                                                                                                  CATHODE      CATHODE                  |
                                                                                                  WATER FLOW   WATER FLOW   FLOW TEST   |
                                                                                                  SWITCH 23    SWITCH 24    GROUP 2 OK  |
                                                                                                  WFS23        WFS24        FTST2_OK    |
                                                                                                    I:056        I:056        B3        |
                                                                                                  ----|/|----------|/|---------( )------|
                                                                                                      16           17           284     |
```

B3/284 - -| |- - File #2 MAIN_PRGRM - 717
-( )- - File #2 MAIN_PRGRM - 715

Rung #716

```
|CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      CATHODE      HEATER       HEATER       HEATER       HEATER       HEATER
|SHIELD H2O   SHIELD H2O   SHIELD H2O   SHIELD H2O   SHIELD       SHIELD       SHIELD H2O   SHIELD H2O   SHIELD H2O   SHIELD H2O   SHIELD H2O
|FLOW         FLOW         FLOW         FLOW         H2O FLOW     H2O FLOW     FLOW         FLOW         FLOW         FLOW         FLOW
|SWITCH 1     SWITCH 2     SWITCH 9     SWITCH 10    SWITCH 17    SWITCH 18    SWITCH 1     SWITCH 2     SWITCH 3     SWITCH 4     SWITCH 5
|CSFS1        CSFS2        CSFS9        CSFS10       CSFS17       CSFS18       HSFS1        HSFS2        HSFS3        HSFS4        HSFS5
|  I:025        I:025        I:041        I:041        I:055        I:055        I:006        I:006        I:006        I:006        I:023
|---|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---
|   04           05           04           05           04           05           10           11           12           13           16
                                                                                                               HEATER                   |
                                                                                                               SHIELD H2O               |
                                                                                                               FLOW         FLOW TEST   |
                                                                                                               SWITCH 6     GROUP 3 OK  |
                                                                                                               HSFS6        FTST3_OK    |
                                                                                                                 I:023        B3        |
                                                                                                               ----|/|---------( )------|
                                                                                                                   17           285     |
```

B3/285 - -| |- - File #2 MAIN_PRGRM - 717
-( )- - File #2 MAIN_PRGRM - 716

```
Rung #717
|FLOW SWITCH  FLOW TEST   FLOW TEST                                                               FLOW TEST CLOSE |
|GROUP 1 OK   GROUP 2 OK  GROUP 3 OK                                                              SUMMARY         |
|FTST1_OK     FTST2_OK    FTST3_OK    WFS_TMR                      WFS_TMR                        FLOW_CL_TST     |
|    B3           B3          B3      ┌─GEQ──────────────────────┐ ┌─LEQ──────────────────────┐         B3          |
|───┤ ├──────────┤ ├────────┤ ├───────┤GRTR THAN OR EQUAL (A>=B) ├─┤LESS THAN OR EQUAL (A<=B) ├────────( )─────────|
|   283          284         285      |SOURCE A:      T4:330.ACC| |SOURCE A:      T4:330.ACC|        286          |
|[714]        [715]       [716]       |                        0| |                        0|                     |
|                                     |SOURCE B:               8| |SOURCE B:               9|                     |
|                                     |                        8| |                        9|                     |
|                                     └──────────────────────────┘ └──────────────────────────┘                     |
|                                     T4:330.ACC - [712]           T4:330.ACC - [712]                               |
Rung #718                                                                                          WATER FLOW      |
|                                                                                                  OPEN TEST       |
|                                                                                                  WFS_OP_TST      |
|  HSFFTMR     WFS_TMR                      WFS_TMR                                                    B3          |
|   T4:93     ┌─GEQ──────────────────────┐ ┌─LEQ──────────────────────┐                                            |
|──┬─┤ ├──┬───┤GRTR THAN OR EQUAL (A>=B) ├─┤LESS THAN OR EQUAL (A<=B) ├───────────────────────────────( )─────────|
|  |   TT   |  |SOURCE A:      T4:330.ACC| |SOURCE A:      T4:330.ACC|                                 339          |
|  |[5:199] |  |                        0| |                        0|                                              |
|  |        |  |SOURCE B:              17| |SOURCE B:              18|                                              |
|  |        |  |                       17| |                       18|                                              |
|  |        |  └──────────────────────────┘ └──────────────────────────┘                                            |
|  |        |  T4:330.ACC - [712]           T4:330.ACC - [712]                                                      |
|  |CFFTMR  |                                                                                                       |
|  | T4:94  |                                                                                                       |
|  └──┤ ├───┘                                                                                                       |
|      TT                                                                                                            |
|   [5:202]                                                                                                          |
Rung #719                                                                                          OPEN WATER      |
|                          WATER FLOW                                                              VALVE FOR TEST  |
|                          SWITCH TIMER                                                            OP_VLV          |
|WFS_TMR                   WFS_TMR                                                                    B3          |
|┌─GEQ──────────────────────┐ ┌─LEQ──────────────────────┐                                                        |
|┤GRTR THAN OR EQUAL (A>=B) ├─┤LESS THAN OR EQUAL (A<=B) ├──────────────────────────────────────────────( )─────────|
||SOURCE A:      T4:330.ACC| |SOURCE A:          T4:330|                                              342          |
||                        0| |                      512|                                                           |
||SOURCE B:              11| |SOURCE B:              19|                                                           |
||                       11| |                       19|                                                           |
|└──────────────────────────┘ └──────────────────────────┘                                                        |
|T4:330.ACC - [712]         T4:330 - [712]                                                                         |
B3/342 - ─┤ ├─ - File #2 MAIN_PRGRM - 721
         ─( )─ - File #2 MAIN_PRGRM - 719
Rung #720                                                                                          CLOSE WATER     |
|                                                                                                  VALVE FOR TEST  |
|                                                                                                  CL_VLV          |
|WFS_TMR                   WFS_TMR                                                                    B3          |
|┌─GEQ──────────────────────┐ ┌─LEQ──────────────────────┐                                                        |
|┤GRTR THAN OR EQUAL (A>=B) ├─┤LESS THAN OR EQUAL (A<=B) ├──────────────────────────────────────────────( )─────────|
| JURCE A:       T4:330.ACC| |SOURCE A:      T4:330.ACC|                                              341          |
||                        0| |                        0|                                                           |
||SOURCE B:               1| |SOURCE B:               9|                                                           |
||                        1| |                        9|                                                           |
|└──────────────────────────┘ └──────────────────────────┘                                                        |
|T4:330.ACC - [712]         T4:330.ACC - [712]                                                                     |
B3/341 - ─┤/├─ - File #2 MAIN_PRGRM - 721
         ─( )─ - File #2 MAIN_PRGRM - 720
```

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```
Rung #721
                          WATER VALVE
  RESET WATER             EMERGENCY OFF                  CLOSE WATER
  VALVE RESET             PUSHBUTTON      MAIN WATER ON  VALVE FOR TEST                WATER VALVES
  RSTH20PB                H20EOFPB        MAIN_H20       CL_VLV                        H20_VLV
     I:024                  I:024           I:002          B3                            B3
|----| |----------+---------| |-------------| |-----------|/|----------------------------( )----|
       16         |          17              07           341                           146
                  |                                      [720]
 |WATER VALVES    |
 |H20_VLV         |
 |   B3           |
 |---| |----------|
 |   146          |
 |[721]           |
 |OPEN WATER      |
 |VALVE FOR TEST  |
 |OP_VLV          |
 |   B3           |
 +---| |----------+
     342
 [719]
B3/146 - -| |- - File #2 MAIN_PRGRM -  721,723,728,731,734,737
         -( )- - File #2 MAIN_PRGRM -  721
Rung #722
                                                                               CHROME WATER
                                                                               ON
  R_OF_DLY                                                                     CHR_ON
  T4:322                                                                         B3
|----|/|----------------------------------------------------------------------(U)----|
      DN                                                                         273
|[728]
B3/273 - -| |- - File #2 MAIN_PRGRM -  724
         -(L)- - File #2 MAIN_PRGRM -  723
         -(U)- - File #2 MAIN_PRGRM -  722
Rung #723
                                                                     CHROME WATER
|WATER VALVES  MAIN WATER ON                                         ON
|H20_VLV       MAIN_H20                                              CHR_ON
|   B3           I:002                                                  B3
|---| |-----------| |-----------------------------------------+--------(L)--------+--|
     146           07                                         |         273        |
|[721]                                                        |                    |
| B3/273 - -| |- - File #2 MAIN_PRGRM - 724                    |                    |
|          -(U)- - File #2 MAIN_PRGRM - 722                    |MAG WATER ON        |
| B3/274 - -| |- - File #2 MAIN_PRGRM - 730                    |MAG_ON              |
|          -(U)- - File #2 MAIN_PRGRM - 729                    |   B3               |
| B3/275 - -| |- - File #2 MAIN_PRGRM - 733                    |--------(L)---------|
|          -(U)- - File #2 MAIN_PRGRM - 732                    |   274              |
  B3/276 - -| |- - File #2 MAIN_PRGRM - 736                    |                    |
           -(U)- - File #2 MAIN_PRGRM - 735                    |CARBON WATER ON     |
|                                                             |CAR_ON              |
|                                                             |   B3               |
|                                                             |--------(L)---------|
|                                                             |   275              |
|                                                             |HEATER WATER ON     |
|                                                             |HTR_ON              |
|                                                             |   B3               |
|                                                             +--------(L)---------+
|                                                                  276
```

```
Rung #724
|CHROME WATER                                                                CHROME RETURN   |
|ON                                                                          VALVE 3         |
|CHR_ON        CHR_OF_DLY                                                    CHRTV3          |
|   B3           T4:322                                                          O:030       |
|---| |----------| |-------------------------------------------------------+------( )------+-|
|   273          DN                                                        |      16       | |
|[723]          [728]                                                      |               | |
| O:030/16 - -| |- - File #2 MAIN_PRGRM - 725                              |CHROME RETURN  | |
| O:030/17 - -| |- - File #2 MAIN_PRGRM - 725                              |VALVE 4        | |
|                                                                          |CHRTV4         | |
|                                                                          |    O:030      | |
|                                                                          +------( )------+ |
|                                                                                 17          |
Rung #725
|CHROME SUPPLY  CHROME SUPPLY  CHROME RETURN  CHROME RETURN                                  |
|VALVE 1        VALVE 2        VALVE 3        VALVE 4                     CHROME WATER OK    |
|CHSUV1         CHSUV2         CHRTV3         CHRTV4                      CHR-OK             |
|   O:030          O:030          O:030          O:030                        B3             |
|----| |----------| |-----------| |-----------| |-------------------------------( )----------|
|     14           15             16             17                            277           |
|[728]          [728]          [724]          [724]                                          |
B3/277 - -| |- - File #2 MAIN_PRGRM -  235,236,238,242
         -|/|- - File #2 MAIN_PRGRM -  237,240,243
         -( )- - File #2 MAIN_PRGRM -  725
Pung #726
  : SUPPLY   MAG SUPPLY  MAG RETURN  MAG RETURN                                              |
|VALVE 5     VALVE 6     VALVE 7     VALVE 8                              MAG WATER OK       |
|MGSUV5      MGSUV6      MGRTV7      MGRTV8                               MAG_OK             |
|  O:044       O:044       O:044       O:044                                  B3             |
|----| |---------| |---------| |---------| |-------------------------------------( )---------|
|    14          15          16 -        17                                    278           |
|[731]       [731]       [730]       [730]                                                   |
B3/278 - -| |- - File #2 MAIN_PRGRM -  267,268,270,274
         -|/|- - File #2 MAIN_PRGRM -  269,272,275
         -( )- - File #2 MAIN_PRGRM -  726
Rung #727
|CARBON SUPPLY  CARBON SUPPLY  CARBON RETURN  CARBON RETURN                                  |
|VALVE 9        VALVE 10       VALVE 11       VALVE 12                    CARBON WATER OK    |
|CASUV9         CASUV10        CARTV11        CARTV12                     CAR_OK             |
|   O:060          O:060          O:060          O:060                        B3             |
|----| |----------| |-----------| |-----------| |-------------------------------( )----------|
|     14           15             16             17                            279           |
|[734]          [734]          [733]          [733]                                          |
B3/279 - -| |- - File #2 MAIN_PRGRM -  299,300
         -( )- - File #2 MAIN_PRGRM -  727
```

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PCT/US 92/00722

```
Rung #728
| CHROME
| CHAMBER
| =<250                                                                          CHROME SUPPLY
| MICRONS          WATER VALVES                                                  VALVE 1
| PIR6             H2O_VLV                                         CHR_ON_DLY    CHSUV1
|   I:024             B3                                            T4:321        O:030
|---] [----------------] [------------------------------------------------] [-------( )---
|   07               146                                              DN             14
|                  [721]                                           [728]
|                  O:030/14 - ] [ - File #2 MAIN_PRGRM - 725
|RESET WATER       O:030/15 - ] [ - File #2 MAIN_PRGRM - 725                   CHROME SUPPLY
|VALVE RESET       T4:321.DN - ] [ - File #2 MAIN_PRGRM - 728                  VALVE 2
|RSTH2OPB          T4:322.DN - ] [ - File #2 MAIN_PRGRM - 724                  CHSUV2
|  I:024                      ]/[ - File #2 MAIN_PRGRM - 722                    O:030
|---] [---                                                                    ---( )---
|   16                                                                            15
|                                                                  CHROME WATER
|                                                                  ON DELAY
|                                                                  CHR_ON_DLY
|                                                                  +-TON-----------------+
|                                                                  |TIMER ON DELAY       |-(EN)-
|                                                                  |TIMER:       T4:321  |
|                                                                  |BASE (SEC):     1.0  |-(DN)
|                                                                  |PRESET:          10  |
|                                                                  |ACCUM:           10  |
|                                                                  +---------------------+
|                                                                  CHROME WATER
|                                                                  OFF DELAY
|                                                                  CHR_OF_DLY
|                                                                  +-TOF-----------------+
|                                                                  |TIMER OFF DELAY      |-(EN)-
|                                                                  |TIMER:       T4:322  |
|                                                                  |BASE (SEC):     1.0  |-(DN)
|                                                                  |PRESET:           2  |
|                                                                  |ACCUM:            0  |
|                                                                  +---------------------+
Rung #729
|MAGNETIC WATER
|OFF DELAY                                                                 MAG WATER ON
|MAG_OF_DLY                                                                MAG_ON
|    T4:324                                                                   B3
|-----]/[------------------------------------------------------------------(U)----
|     DN                                                                      274
|[731]
B3/274 - ] [ - File #2 MAIN_PRGRM - 730
         -(L)- - File #2 MAIN_PRGRM - 723
         -(U)- - File #2 MAIN_PRGRM - 729
Rung #730
                   MAGNETIC WATER                                          MAG RETURN
|MAG WATER ON      OFF DELAY                                               VALVE 7
|MAG_ON            MAG_OF_DLY                                              MGRTV7
|   B3                T4:324                                                 O:044
|---] [----------------] [-----------------------------------------------------( )---
|   274                 DN                                                      16
|[729]             [731]
| O:044/16 - ] [ - File #2 MAIN_PRGRM - 726
| O:044/17 - ] [ - File #2 MAIN_PRGRM - 726                                MAG RETURN
|                                                                          VALVE 8
|                                                                          MGRTV8
|                                                                            O:044
|                                                                         ---( )---
|                                                                             17
```

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```
Rung #731
| MAGNETIC                                                                               MAG SUPPLY
| CHAMBER                                                                                VALVE 5
| =<250                                                                   MAG_ON_DLY     MGSUV5
| MICRONS         WATER VALVES                                              T4:323        O:044
| PIR11           H20_VLV                                                 --] [--------( )--
|  I:040            B3                                                        DN           14
|--] [--------------] [---------------------------------------------------
|    07            146                                                    [731]
|                 [721]
|                 O:044/14 - -] [- - File #2 MAIN_PRGRM - 726
|                 O:044/15 - -] [- - File #2 MAIN_PRGRM - 726                            MAG SUPPLY
| RESET WATER     T4:323.DN - -] [- - File #2 MAIN_PRGRM - 731                           VALVE 6
| VALVE RESET     T4:324.DN - -] [- - File #2 MAIN_PRGRM - 730                           MGSUV6
| RSTH2OPB                   -]/[- - File #2 MAIN_PRGRM - 729                              O:044
|    I:024                                                                              --( )--
|--] [--                                                                                   15
|    16
|                                                                         MAG WATER
|                                                                         ON DELAY
|                                                                         MAG_ON_DLY
|                                                                         +--TON-----------+
|                                                                         |TIMER ON DELAY  |-(EN)-
|                                                                         |TIMER:   T4:323 |
|                                                                         |BASE (SEC):  1.0|-(DN)
|                                                                         |PRESET:      10 |
|                                                                         |ACCUM:       10 |
|                                                                         +----------------+
|                                                                         MAG WATER
|                                                                         OFF DELAY
|                                                                         MAG_OF_DLY
|                                                                         +--TOF-----------+
|                                                                         |TIMER OFF DELAY |-(EN)-
|                                                                         |TIMER:   T4:324 |
|                                                                         |BASE (SEC):  1.0|-(DN)
|                                                                         |PRESET:       2 |
|                                                                         |ACCUM:        0 |
|                                                                         +----------------+
Rung #732
|                                                                                  CARBON WATER ON
| CAR_OF_DLY                                                                       CAR_ON
|   T4:326                                                                           B3
|--]/[-------------------------------------------------------------------------------(U)--
|    DN                                                                              275
| [734]
B3/275 - -] [- - File #2 MAIN_PRGRM -  733
         -(L)- - File #2 MAIN_PRGRM -  723
         -(U)- - File #2 MAIN_PRGRM -  732
Rung #733
|                                                                                  CARBON RETURN
| RBON WATER ON                                                                    VALVE 11
| CAR_ON          CAR_OF_DLY                                                       CARTV11
|    B3             T4:326                                                           O:060
|--] [---------------] [------------------------------------------------------------( )--
|   275              DN                                                                16
| [732]           [734]
| O:060/16 - -] [- - File #2 MAIN_PRGRM - 727
| O:060/17 - -] [- - File #2 MAIN_PRGRM - 727                                      CARBON RETURN
|                                                                                  VALVE 12
|                                                                                  CARTV12
|                                                                                    O:060
|                                                                                  --( )--
|                                                                                      17
```

Rung #734

CARBON CHAMBER =<250 MICRONS PIR16 I:054 07

RESET WATER VALVE RESET RSTH20PB I:024 16

WATER VALVES H20_VLV B3 146

[721]
0:060/14 - ┤ ├ - File #2 MAIN_PRGRM - 727
0:060/15 - ┤ ├ - File #2 MAIN_PRGRM - 727
T4:325.DN - ┤ ├ - File #2 MAIN_PRGRM - 734
T4:326.DN - ┤ ├ - File #2 MAIN_PRGRM - 733
┤/├ - File #2 MAIN_PRGRM - 732

CAR_ON_DLY T4:325 DN
[734]

CARBON SUPPLY VALVE 9 CASUV9 0:060 ( ) 14

CARBON SUPPLY VALVE 10 CASUV10 0:060 ( ) 15

CARBON WATER ON DELAY CAR_ON_DLY
TON
TIMER ON DELAY (EN)
TIMER: T4:325
BASE (SEC): 1.0 (DN)
PRESET: 10
ACCUM: 10

CARBON WATER OFF DELAY CAR_OF_DLY
TOF
TIMER OFF DELAY (EN)
TIMER: T4:326
BASE (SEC): 1.0 (DN)
PRESET: 2
ACCUM: 0

Rung #735

HTR_OF_DLY T4:328 ┤/├ DN
[737]

HEATER WATER ON HTR_ON B3 (U) 276

B3/276 - ┤ ├ - File #2 MAIN_PRGRM - 736
-(L)- - File #2 MAIN_PRGRM - 723
-(U)- - File #2 MAIN_PRGRM - 735

Rung #736

ATER WATER ON HTR_ON B3 276
[735]

HTR_OF_DLY T4:328 DN
[737]

HEATER WATER VALVE 2 WH202 0:010 ( ) 17

0:010/17 - ┤ ├ - File #2 MAIN_PRGRM - 147,148
┤/├ - File #2 MAIN_PRGRM - 149,150
-( )- - File #2 MAIN_PRGRM - 736

Rung #737

```
HEATER 1   CHROME
CHAMBER    CHAMBER
=<250      =<250
MICRONS    MICRONS    WATER VALVES                                HEATER WATER
PIR2       PIR6       H20_VLV                                     VALVE 1
I:004      I:024      B3                             HTR_ON_DLY   HH201
                                                     T4:327       O:010
--| |--------| |--------| |----------------------------| |-----------( )--
  10         07         146                             DN          16
                     [721]                           [737]
                     O:010/16 - -| |- - File #2 MAIN_PRGRM - 147, 148
                                -|/|- - File #2 MAIN_PRGRM - 149, 150
RESET WATER          T4:327.DN - -| |- - File #2 MAIN_PRGRM - 737
VALVE RESET          T4:328.DN - -| |- - File #2 MAIN_PRGRM - 736
RSTH20PB                         -|/|- - File #2 MAIN_PRGRM - 735
  I:024
--| |--
  16
                                                     HEATER WATER
                                                     ON DELAY
                                                     HTR_ON_DLY
                                                     +-TON---------------+
                                                     |TIMER ON DELAY     |-(EN)-
                                                     |TIMER:      T4:327 |
                                                     |BASE (SEC):    1.0 |-(DN)
                                                     |PRESET:         10 |
                                                     |ACCUM:          10 |
                                                     +-------------------+
                                                     HEATER WATER
                                                     OFF DELAY
                                                     HTR_OF_DLY
                                                     +-TOF---------------+
                                                     |TIMER OFF DELAY    |-(EN)-
                                                     |TIMER:      T4:328 |
                                                     |BASE (SEC):    1.0 |-(DN)
                                                     |PRESET:          2 |
                                                     |ACCUM:           0 |
                                                     +-------------------+
```

Rung #738

```
                                                     JUMP TO CRYO
                                                     REGEN
                                                     TO_CRGN
                                                     +-JSR---------------+
-----------------------------------------------------|JUMP TO SUBROUTINE |-
                                                     |FILE #:        U:3 |
                                                     |INPUT  PAR:        |
                                                     |RETURN PAR:        |
                                                     +-------------------+
```

Rung #739

```
                                                     JUMP TO RETURN
                                                     CONVEYOR SUBRTN
                                                     JMP_TO_RTN
                                                     +-JSR---------------+
-----------------------------------------------------|JUMP TO SUBROUTINE |-
                                                     |FILE #:        U:4 |
                                                     |INPUT  PAR:        |
                                                     |RETURN PAR:        |
                                                     +-------------------+
```

Rung #740

```
                                                     GOTO FAULT
                                                     RUNGS
                                                     TO__FLT
                                                     +-JSR---------------+
-----------------------------------------------------|JUMP TO SUBROUTINE |-
                                                     |FILE #:        U:5 |
                                                     |INPUT  PAR:        |
                                                     |RETURN PAR:        |
                                                     +-------------------+
```

```
Rung #741
                                                              JUMP TO TECH
                                                              RUNGS
                                                              JMP_TR
                                                              +-JSR--------------+
|-------------------------------------------------------------+JUMP TO SUBROUTINE+-|
|                                                             |FILE #:       U:6|
|                                                             |INPUT  PAR:      |
|                                                             |RETURN PAR:      |
|                                                             +-----------------+
Rung #742
|------------------------------------------------------------------------(END)---|
```

466


```
Rung #000
                                                                            COMPRESSOR
                                                                            1 REGEN-
 REGENERATE    ABORT CRYO                                                   ERATION
 CRYO 1        TIMER                                                        PROGRAM
 TS01          ABORTCRYO                                                    CYRGN1
   N7:15         T4:297                                                        B3
|----| |-------+----|/|-------------------------------------------------+-----(L)-----+
|      9       |      TT                                                |     321     |
| [2:3]        | [27]                                                   |             |
|              |                                                        |MANUAL       |
|              | B3/321 - -| |- - File #2 MAIN_PRGRM - 115, 458          |COMPRESSOR 1 |
|              |              File #3 CRYO_REGEN - 1, 3, 4, 5, 21, 29, 30, 259  |REGENERATION |
|              |              File #6 TECH_RUNGS - 14                   |ENABLE       |
|REGENERATE    |        -|/|- - File #2 MAIN_PRGRM - 26, 115           |MC1RE        |
|ALL CRYO'S    |              File #3 CRYO_REGEN - 10, 12, 14, 17, 21, 23, 24, 33  |   N7:36     |
|TS20          |        -(U)- - File #3 CRYO_REGEN - 25                 +-----(L)-----+
|  N7:16       | N7:36/9 - -(U)- - File #3 CRYO_REGEN - 25                      9
+----| |-------+ _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
       12
 [2:3]
Rung #001
COMPRESSOR    HEATER 1
1 REGEN-      CHAMBER
ERATION       GATE VALVE                                        REGEN COMP. 1
PROGRAM       CLOSE                                             PULSE TIMER
CYRGN1        HV1S1                                             CR1PT
  B3            I:002                                          +-TON--------------+
|----| |---------| |-------------------------------------------+-+TIMER ON DELAY    +-(EN)-+
     321          06                                          | |TIMER:     T4:61  |      |
[0]                                                           | |BASE (SEC):  1.0  +-(DN) |
                                                              | |PRESET:        1  |      |
T4:61.TT - -| |- - File #3 CRYO_REGEN - 5, 6, 7                | |ACCUM:         0  |      |
T4:341.ACC - LEQ - File #3 CRYO_REGEN - 3                     | +------------------+      |
T4:341.TT - -| |- - File #3 CRYO_REGEN - 2, 263                |                           |
            -|/|- - File #3 CRYO_REGEN - 264                  |SIEVE TRAP                 |
                                                              |1 TIMER                    |
                                                              |S_TRAP_1                   |
                                                              | +-TON--------------+      |
                                                              +-+TIMER ON DELAY    +-(EN)-+
                                                                |TIMER:    T4:341  |
                                                                |BASE (SEC):  1.0  +-(DN)
                                                                |PRESET:     5400  |
                                                                |ACCUM:         0  |
                                                                +------------------+
```

```
Rung #002
|                MECHANICAL                                                      SIEVE TRAP     |
|                PUMP 2                                                          ISOLATION TRAP |
|                ISOLATION                                                       1              |
|                VALVE OPEN                                                      SVIV1          |
| S_TRAP_1       MP2IVOP                                                            O:010       |
|  T4:341        I:025                                                                          |
|---] [-------+----] [--------------------------------------------------------------( )--------|
| |  TT       |    13                                                                 00        |
| |[1]        |                                                                               |
| |           | O:010/00 - ] [ - File #3 CRYO_REGEN - 3                                         |
| |OPEN       |                                                                               |
| |CRYO ROUGH |                                                                               |
| |VALVE 1    |                                                                               |
| |CR1        |                                                                               |
| |   O:007   |                                                                               |
| +----] [----+                                                                               |
|      11                                                                                     |
| [15]
Rung #003
|COMPRESSOR                                                                                    |
|1 REGEN-                                                                                      |
|ERATION                          SIEVE TRAP                                    SIEVE TRAP     |
|PROGRAM                          ISOLATION TRAP                                1 HEATER       |
|CYRGN1      S_TRAP_1             1                                             SVHTR1         |
|   B3       +-LEQ-------------------+ SVIV1                                        O:010       |
|---] [------|LESS THAN OR EQUAL (A<=B)|----] [--------------------------------------( )--------|
|   321      |SOURCE A:     T4:341.ACC|     00                                          12       |
|[0]         |                      0| [2]                                                     |
|            |SOURCE B:          3600|                                                         |
|            |                   3600|                                                         |
|            +-----------------------+                                                         |
|            T4:341.ACC - [1]                                                                  |
Rung #004
|COMPRESSOR                                                                                    |
|1 REGEN-                                                                       SCREEN         |
|ERATION                                                                        REGENERATION   |
|PROGRAM                                                                        CRYO 1         |
|CYRGN1                                                                         SCRRGN1        |
|   B3                                                                              B3          |
|---] [------------------------------------------------------------------------------( )-------|
|   321                                                                             801         |
|[0]
Rung #005
|COMPRESSOR                                                                                    |
|1 REGEN-                                                                                      |
|ERATION      CRYO REGEN                                                                       |
|PROGRAM      1 PULSE                                                            PURGE 1       |
|CYRGN1       CR1PT                                                              P1            |
|   B3         T4:61                                                                 B3        |
|---] [--------] [-------------------------------------------------------------------(L)-------|
|   321         TT                                                                   631       |
|[0]          [1]                                                                              |
B3/631 - ] [ - File #3 CRYO_REGEN -  7,9,11
               File #6 TECH_RUNGS -  15
        -(L)- - File #3 CRYO_REGEN -  5
        -(U)- - File #3 CRYO_REGEN -  12
```

```
Rung #006
                                                                         ENABLE
                                                                         CRYO
| CRYO REGEN                                                             COMPRESSOR
| 1 PULSE                                                                1
| CR1PT                                                                  CY1
|   T4:61                                                                  O:010
|---] [---------------------------------------------------------------+---(U)---+
| |   TT   |                                                          |    04    |
| |[1]     |                                                          |          |
| |        | O:010/04 - -] [- - File #2 MAIN_PRGRM - 437              |MANUAL CRYO
| |MANUAL  |                   File #3 CRYO_REGEN - 260               |COMPRESSOR 1
| |CONTROL |                   File #6 TECH_RUNGS - 19                |STOP
| |STOP CRYO|             -(L)- - File #2 MAIN_PRGRM - 26             |MCYC1STOP
| |COMPRESSOR| N7:29/5 - -(U)- - File #2 MAIN_PRGRM - 26              |   N7:29
| |1       | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              |---(L)---+
| |M-CY1-0 | N7:34/5 - -(L)- - File #2 MAIN_PRGRM - 26                |    5
| |  N7:8  | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              |
| |---] [--+                                                          |MANUAL CRYO
| |   5    |                                                          |COMPRESSOR 1
| |[2:3]   |                                                          |RUN
| |        |                                                          |MCYC1RUN
| |        |                                                          |   N7:34
| |MAIN WATER ON                                                      +---(U)---+
| |MAIN_H20|                                                               5
| |  I:002 |
| +---]/[--+
|     07
Rung #007
|                          OPEN
|            CRYO REGEN    CRYO ROUGH                                   OPEN PURGE
|PURGE 1     1 PULSE       VALVE 1                                      VALVE 1
|P1          CR1PT         CR1                                          HIF1
|  B3          T4:61         O:007                                        O:007
|---] [---------] [-----------]/[------------------------------------------(L)---|
|  631          TT            11                                          06
|[5]          [1]           [15]
O:007/06 - -] [- - File #3 CRYO_REGEN - 8
                   File #6 TECH_RUNGS - 16
           -(L)- - File #3 CRYO_REGEN - 7
           -(U)- - File #3 CRYO_REGEN - 10
Rung #008                                                               ENABLE
|                                                                       PURGE
|OPEN PURGE                                                             HEATER 1
|VALVE 1                                                                HIH1
|HIF1                                                                     O:007
|  O:007
|---] [--------------------------------------------------------------------( )---|
|    06                                                                   03
|[7]
O:007/03 - -] [- - File #3 CRYO_REGEN - 9
           -( )- - File #3 CRYO_REGEN - 8
```

```
Rung #009
|         ENABLE     CYRO 1       PURGE                                        PURGE TIME                |
|         PURGE      TEMPERATUR   TIMER                                        MONITOR                   |
|PURGE 1  HEATER 1   =>290K       DEFEAT                                       COMPRESSOR 1              |
|P1       NIH1       CY1TMP290    PG_DEFEAT                                    PGC1                      |
|  B3      O:007      B3          B3                                          +-TON-------------+        |
|--| |-----| |--------| |---------| |-----------------------------------------+TIMER ON DELAY   +-(EN)-|
|  631      03        513         288                                         |TIMER:      T4:21|       |
|[12]     [8]                                                                 |BASE (SEC):  1.0 +-(DN)  |
|                                                                             |PRESET:     7200 |       |
|                                                                             |ACCUM:         0 |       |
|                                                                             +-----------------+       |
T4:21.ACC - GEQ - File #3 CRYO_REGEN -  30
T4:21.DN - -| |- - File #3 CRYO_REGEN -  10,11,262
T4:21.TT - -| |- - File #6 TECH_RUNGS -  15
Rung #010
|               PURGE TIME                                                                              |
|               MONITOR                                                                                 |
| CYRO 1        CRYO 1                                                                                  |
| TEMPERATUR    60 MIN       BLOWER 2                                                      OPEN PURGE   |
| =>290K        DONE         ENABLED                                                       VALVE 1      |
| CY1TMP290     PGC1         BL2                                                           NIF1         |
|     B3          T4:21       O:027                                                          O:007      |
|-+---| |-----------| |-------| |----+---------------------------------------------------------(U)------|
| |    513          DN          01   |                                                         06       |
| |              [9]         [2:74]  |                                                                  |
|                                    | O:007/06 - -| |- - File #3 CRYO_REGEN - 8                        |
| |                                  |                    File #6 TECH_RUNGS - 16                       |
| |COMPRESSOR                        |            -(L)- - File #3 CRYO_REGEN - 7                        |
| |1 REGEN-                          |                                                                  |
| |ERATION                           |                                                                  |
| |PROGRAM                           |                                                                  |
| |CYRGN1                            |                                                                  |
| |     B3                           |                                                                  |
| +----|/|---------------------------+                                                                  |
|      321                                                                                              |
| [0]                                                                                                   |
Rung #011
|         PURGE TIME                                                                                    |
|         MONITOR                                                                                       |
|         CRYO 1       CYRO 1                                                                           |
|         60 MIN       TEMPERATUR   BLOWER 2                                            ROUGHING       |
|PURGE 1  DONE         =>290K       ENABLED                                             AND ROR 1      |
|P1       PGC1         CY1TMP290    BL2                                                 R&ROR1         |
|  B3       T4:21        B3          O:027                                                 B3           |
|--| |-------| |---------| |---------| |------------------------------------------------(L)-----------|
|  631       DN          513          01                                                 641           |
 [12]     [9]                      [2:74]                                                               |
3/641 - -| |- - File #3 CRYO_REGEN -  12,15,16,17,18,19,20
                File #6 TECH_RUNGS -  17
        -(L)- - File #3 CRYO_REGEN -  11
        -(U)- - File #3 CRYO_REGEN -  21
```

```
Rung #012
| ROUGHING                                                          PURGE 1 |
| AND ROR 1                                                         P1      |
| R&ROR1                                                               B3   |
|     B3                                                                    |
|-+---| |---+------------------------------------------------------(U)-----|
| |   641   |                                                        631    |
| |[11]     |                                                               |
| |         | B3/631 - -| |- - File #3 CRYO_REGEN - 7, 9, 11                |
| |         |                  File #6 TECH_RUNGS - 15                      |
| |COMPRESSOR|         -(L)- - File #3 CRYO_REGEN - 5                       |
| |1 REGEN- |                                                               |
| |ERATION  |                                                               |
| |PROGRAM  |                                                               |
| |CYRGN1   |                                                               |
| |    B3   |                                                               |
| +---|/|---+                                                               |
|     321                                                                   |
|  [0]
Rung #013
|MANUAL                                                                     |
|CONTROL                                                                    |
|CRYO ROUGH                                                 MANUAL CRYO    |
|VALVE 1                                                    ROUGH 1        |
|OPEN                                                       OPEN           |
 ---CR1-1                                                   MCR1OP         |
   N7:12                                                       N7:33       |
|-----| |--------------------------------------------------+----(L)----+---|
|      9                                                   |      9     |  |
|[2:3]                                                     |            |  |
| N7:33/9 - -| |- - File #3 CRYO_REGEN - 15                |MANUAL CRYO |  |
|              -(U)- - File #3 CRYO_REGEN - 14             |ROUGH  1    |  |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2              |CLOSE       |  |
| N7:28/9 - -(L)- - File #3 CRYO_REGEN - 14                |MCR1CL      |  |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2              |    N7:28   |  |
|                                                          +----(U)----+  |
|                                                                 9        |
Rung #014
| MANUAL                                                                    |
| CONTROL                                                                   |
| CLOSE CRYO                                                MANUAL CRYO    |
| ROUGH                                                     ROUGH 1        |
| VALVE 1                                                   OPEN           |
| M-CR1-O                                                   MCR1OP         |
|     N7:7                                                      N7:33      |
|-+---| |-----------------------+--------------------------+----(U)----+---|
| |    9                        |                          |      9     |  |
| |[2:3]                        |                          |            |  |
| |                             | N7:33/9 - -| |- - File #3 CRYO_REGEN - 15
| |                             |              -(L)- - File #3 CRYO_REGEN - 13
| |COMPRESSOR                   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
| |1 REGEN-      CRYO 1         | N7:28/9 - -(U)- - File #3 CRYO_REGEN - 13
| |ERATION       TEMPERATUR     | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
| |PROGRAM       =<20K          |                          |MANUAL CRYO |  |
| |CYRGN1        CY1TMP20       |                          |ROUGH  1    |  |
| |    B3            B3         |                          |CLOSE       |  |
| +---|/|-----------| |---------+                          |MCR1CL      |  |
|     321           501                                    |    N7:28   |  |
| [25]                                                     +----(L)----+  |
|                                                                 9        |
```

```
Rung #015
|                                                        CRYO 1                                                  |
| ROUGHING   COMPRESSOR 1   LINE PRESSURE  BLOWER 2  THERMCOUPL                           OPEN                   |
| AND ROR 1  ROR LATCH      MADE-TC10      ENABLED   50 MICRON                            CRYO ROUGH             |
| R&ROR1     CY1RORL        LPM-TC10       BL2       PIR3                                 VALVE 1                |
|    B3         B3              B3         O:027      I:004                               CR1                    |
|                                                                                           O:007                |
|-+--] [-------]/[----+--------] [--------] [--------]/[------------------------------+-------( )---------+-|
| |  641        601   |        250         01          11                             |        11        | |
| |[11]        [16]   | [2:671]           [2:74]                                      |                  | |
| |                   | O:007/11 - ] [ - File #3 CRYO_REGEN - 2                        |CRYO REGEN 1      | |
| |                   |                  File #6 TECH_RUNGS - 14                        |ROUGHING          | |
| |MANUAL CRYO CRYO 1 |           ]/[ - File #2 MAIN_PRGRM - 115, 387                   |TIMER             | |
| |ROUGH 1  TEMPERATUR|                  File #3 CRYO_REGEN - 7                         |CR1RUF_TMR        | |
| |OPEN     =<20K     | T4:171.DN - ] [ - File #3 CRYO_REGEN - 31                        |+-TON-----------+ | |
| |MCR1OP   CY1TMP20  |                                                                 +|TIMER ON DELAY |-(EN)-+
| |  N7:33     B3     |                                                                  |TIMER:   T4:171|
| |--] [------]/[-----|                                                                  |BASE (SEC): 1.0|-(DN)
| |   9        501    |                                                                  |PRESET:     600|
| |[14]               |                                                                  |ACCUM:        0|
| |                   |                                                                  +---------------+
| |COOL DOWN          |
| |1                  |
| |CD1                |
| |   B3              |
| +--] [--------------+
|   651
  [20]

Rung #016
|          CRYO 1                 CRYO 1                                                                         |
|ROUGHING  THERMCOUPL  BLOWER 2   ROR LATCH                                                      COMPRESSOR 1   |
|AND ROR 1 50 MICRON   ENABLED    ONE SHOT                                                       ROR LATCH      |
|R&ROR1    PIR3        BL2        C1RORLOS                                                       CY1RORL        |
|   B3      I:004       O:027      B3                                                                B3        |
|---] [------] [---------] [--------[ONS]--------------------------------------------------------------(L)------|
|  641        11          01        551                                                                601       |
|[11]                   [2:74]                                                                                  |
B3/601 - ] [ - File #3 CRYO_REGEN - 18
               File #6 TECH_RUNGS - 17
         ]/[ - File #3 CRYO_REGEN - 15
         -(L)- - File #3 CRYO_REGEN - 16
         -(U)- - File #3 CRYO_REGEN - 17

Rung #017
|            ROR WAIT                                                                                           |
|            CRYO 1                                                                                             |
| ROUGHING   60 SEC                                                                              COMPRESSOR 1  |
| AND ROR 1  DONE                                                                                ROR LATCH     |
| R&ROR1     C1RORTMR                                                                            CY1RORL       |
|    B3       T4:31                                                                                  B3        |
|-+--] [-------] [----+------------------------------------------------------------------------------(U)------|
| |  641         DN   |                                                                              601       |
| |[21]        [18]   |                                                                                       |
| |                   | B3/601 - ] [ - File #3 CRYO_REGEN - 18                                                |
| |                   |                File #6 TECH_RUNGS - 17                                                |
| |COMPRESSOR         |          ]/[ - File #3 CRYO_REGEN - 15                                                |
| |1 REGEN-           |          -(L)- - File #3 CRYO_REGEN - 16                                              |
| |ERATION            |                                                                                       |
| |PROGRAM            |                                                                                       |
| |CYRGN1             |                                                                                       |
| |      B3           |                                                                                       |
| +-----]/[-----------+                                                                                       |
|       321                                                                                                     |
| [25]                                                                                                          |
```

Rung #018

```
|ROUGHING    COMPRESSOR 1                                        ROR WAIT           |
|AND ROR 1   ROR LATCH                                           COMPRESSOR 1       |
|R&ROR1      CY1RORL                                             60 SEC             |
|  B3          B3                                                C1RORTMR           |
|                                                                +-TON-----------+  |
|---] [-------] [------------------------------------------------|TIMER ON DELAY |-(EN)-|
|  641         601                                               |TIMER:   T4:31 |  |
|[21]        [17]                                                |BASE (SEC): 1.0|-(DN) |
|                                                                |PRESET:     30 |  |
|                                                                |ACCUM:       0 |  |
|                                                                +---------------+  |
T4:31.DN - ] [ - File #3 CRYO_REGEN - 17,20
T4:31.TT - ] [ - File #6 TECH_RUNGS - 18
```

Rung #019

```
|                                                                REROUGH            |
|            CRYO 1                                              COUNTER            |
|ROUGHING    THERMCOUPL                                          COMPRESSOR         |
|AND ROR 1   50 MICRON                                           1                  |
|R&ROR1      PIR3                                                C1RERUF            |
|  B3          I:004                                             +-CTU-----------+  |
|---] [-------]/[------------------------------------------------|COUNT UP       |-(CU)-|
|  641         11                                                |COUNTER:  C5:1 |  |
|[21]                                                            |PRESET:     20 |-(DN) |
|                                                                |ACCUM:       0 |  |
|                                                                +---------------+  |
   .1 - CTU - File #3 CRYO_REGEN - 19
        RES - File #3 CRYO_REGEN - 23
C5:1.DN - ] [ - File #2 MAIN_PRGRM - 623
```

Rung #020

```
|                        ROR WAIT                                                   |
|            CRYO 1      CRYO 1     CRYO 1                                          |
|ROUGHING    THERMCOUPL  60 SEC     TEMPERATUR                          COOL DOWN   |
|AND ROR 1   50 MICRON   DONE       =<20K                               1           |
|R&ROR1      PIR3        C1RORTMR   CY1TMP20                            CD1         |
|  B3          I:004       T4:31      B3                                   B3       |
|---] [-------] [---------] [--------]/[--------------------------------------(L)---|
|  641         11          DN         501                                  651      |
|[21]                    [18]                                                       |
B3/651 - ] [ - File #2 MAIN_PRGRM - 26,115
               File #3 CRYO_REGEN - 15,21,22,25
               File #6 TECH_RUNGS - 19
       -(L)- - File #3 CRYO_REGEN - 20
       -(U)- - File #3 CRYO_REGEN - 24
```

```
Rung #021
| COMPRESSOR
| 1 REGEN-
| ERATION              COOL DOWN                                        ROUGHING  |
| PROGRAM              1                                                AND ROR 1 |
| CYRGN1      PDM1     CD1                                              R&ROR1    |
|    B3       T4:41     B3                                                 B3     |
|-+--| |------| |------| |-+--------------------------------------------(U)-----|
| |  321         TT     651 |                                              641    |
| |[25]        [22]   [20]  |                                                    |
| |                         | B3/641 - -| |- - File #3 CRYO_REGEN - 12, 15, 16, 17, 18, 19, 20
| |                         |                File #6 TECH_RUNGS - 17
| |COMPRESSOR               |          -(L)- - File #3 CRYO_REGEN - 11
| |1 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN1                   |
| |    B3                   |
| +---|/|-------------------+
|    321
|  [25]
Rung #022
|           CRYO 1                                                 REGEN          |
|COOL DOWN  TEMPERATUR                                             TIME TO        |
|1          =<20K                                                  20K  1         |
|CD1        CY1TMP20                                               PDM1           |
    B3         B3                                                  +-TON--------+
+---| |--------|/|-------------------------------------------------+|TIMER ON DELAY |-(EN)-|
|   651        501                                                 |TIMER:   T4:41|
|[20]                                                              |BASE (SEC): 1.0|-(DN) |
|                                                                  |PRESET:   7200|
|                                                                  |ACCUM:       0|
|                                                                  +--------------+
T4:41.DN - -| |- - File #3 CRYO_REGEN -  30,32
T4:41.TT - -| |- - File #3 CRYO_REGEN -  21



,[25]
C5:1 - CTU - File #3 CRYO_REGEN -  19
       RES - File #3 CRYO_REGEN -  23
C5:1.DN - -| |- - File #2 MAIN_PRGRM -  623
Rung #024
|COMPRESSOR                                                                       |
|1 REGEN-                                                                         |
|ERATION                                                           COOL DOWN      |
|PROGRAM                                                           1              |
|CYRGN1                                                            CD1            |
|   B3                                                                 B3         |
+---|/|----------------------------------------------------------------(U)--------|
|  321                                                                 651        |
|[25]                                                                             |
B3/651 - -| |- - File #2 MAIN_PRGRM -  26,115
                 File #3 CRYO_REGEN -  15,21,22,25
                 File #6 TECH_RUNGS -  19
         -(L)- - File #3 CRYO_REGEN -  20
```

```
BASE :   Rung #023
| COMPRESSOR  CRYO 1                                                          REROUGH     |
| 1 REGEN-    COUNTER                                                         COUNTER     |
| ERATION     RESET                                                           COMPRESSOR  |
| PROGRAM     ONE SHOT                                                        1           |
| CYRGN1      C1CROS                                                          C1RERUF     |
|       B3          B3                                                            C5:1    |
|-+----|/|------[ONS]-+-------------------------------------------------------[RES]-------|
| |   321         561 |                                                                   |
| |[25]               |                                                                   |
| |                   | C5:1 - CTU - File #3 CRYO_REGEN - 19                              |
| |                   | C5:1.DN - -| |- - File #2 MAIN_PRGRM - 624                        |
| |PAUSE              |                                                                   |
| |DISABLE            |                                                                   |
| |TS12               |                                                                   |
| |  N7:16            |                                                                   |
| +----| |------------+                                                                   |
|      4                                                                                  |
| [2:3]                                                                                   |
```

475

```
    -(U)- - File #3 CRYO_REGEN -  24
Rung #025
                                                                      COMPRESSOR
        CRYO 1                                                        1 REGEN-
 COOL DOWN  TEMPERATUR                                                ERATION
 1          =<20K                                                     PROGRAM
 CD1        CY1TMP20                                                  CYRGN1
    B3         B3                                                        B3
---] [--------] [-------------------------------------------------------(U)---
   651        501                                                       321
 [24]
                          B3/321 - -| |- - File #2 MAIN_PRGRM - 115, 458       MANUAL
                                           File #3 CRYO_REGEN - 1, 3, 4, 5, 21, 29, 30, 259   COMPRESSOR 1
                                           File #6 TECH_RUNGS - 14             REGENERATION
                                     -|/|- - File #2 MAIN_PRGRM - 26, 115      ENABLE
  REGENERATE   ABORT CRYO                  File #3 CRYO_REGEN - 10, 12, 14, 17, 21, 23, 24, 33   MC1RE
  CRYO 1       TIMER                 -(L)- - File #3 CRYO_REGEN - 0               N7:36
  TS01         ABORTCRYO   N7:36/9 - -(L)- - File #3 CRYO_REGEN - 0           ----(U)----
    N7:15        T4:297    _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2             9
---] [--------] [---
     9           TT
   [2:3]        [27]
   REGENERATE
   ALL CRYO'S
   TS20
     N7:16
---] [---
     12
  [2:3]
 PIRANI
 GUAGE 2
 NO FAULT
 PGNF2
   I:004
---]/[---
    15
 CRYO RE-
 GENERATION
 FAULT
 COMPRESSOR
 1
 CRFLT1
    B3
---] [---
   331
 [30]
 PREPARE FOR
 AUTO RUN
 >AUTO
   N7:37
---] [---
     1
 [2:157]
Rung #026
ABORT CRYO                                                            ABORT CRYO
REGENERATION                                                          REGEN ENABLE
BT_CR                                                                 ABORTCRGN
  N7:17                                                                  B3
---] [------------------------------------------------------------------(L)---
    9                                                                    297
[2:3]
B3/297 - -| |- - File #2 MAIN_PRGRM -  21
```

```
                File #3 CRYO_REGEN -  27
       -(L)- - File #3 CRYO_REGEN -  26
       -(U)- - File #3 CRYO_REGEN -  28
Rung #027
|ABORT CRYO                                                          ABORT CRYO            |
|REGEN ENABLE                                                        REGEN TIMER           |
|ABORTCRGN                                                           ABORTCRYO             |
|      B3                                                            +-TON--------------+  |
|-----| |------------------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|     297                                                            |TIMER:    T4:297  |  |
|[26]                                                                |BASE (SEC):  1.0  |-(DN) |
|                                                                    |PRESET:       10  |  |
|                                                                    |ACCUM:         0  |  |
|                                                                    +------------------+  |
T4:297.DN - -| |- - File #3 CRYO_REGEN -  28
T4:297.TT - -| |- - File #2 MAIN_PRGRM -  91
                    File #3 CRYO_REGEN -  25,238,239,240,241,242,243,244
               -|/|- - File #3 CRYO_REGEN -  0,34,38,42,46,52,53,57,63
Rung #028
|                                                                         ABORT CRYO  |
|                                                                         REGEN ENABLE|
|ABORTCRYO                                                                ABORTCRGN   |
|  T4:297                                                                    B3       |
|-----| |------------------------------------------------------------------(U)--------|
|     DN                                                                     297      |
|[27]
-/297 - -| |- - File #2 MAIN_PRGRM -  21
                File #3 CRYO_REGEN -  27
       -(L)- - File #3 CRYO_REGEN -  26
       -(U)- - File #3 CRYO_REGEN -  28
Rung #029
|COMPRESSOR  HEATER 1                                                                      |
|1 REGEN-    CHAMBER                                                 CRYO REGEN            |
|ERATION     GATE VALVE                                              COMPRESSOR 1          |
|PROGRAM     CLOSE                                                   HV1 FAULT             |
|CYRGN1      HV1S1                                                   CR1FLT                |
|    B3        I:002                                                 +-TON--------------+  |
|----| |--------|/|--------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   321         06                                                   |TIMER:     T4:11  |  |
|[25]                                                                |BASE (SEC):  1.0  |-(DN) |
|                                                                    |PRESET:       30  |  |
|                                                                    |ACCUM:         0  |  |
|                                                                    +------------------+  |
T4:11.DN - -| |- - File #3 CRYO_REGEN -  30
```

Rung #030

```
|           COOL DOWN                                                       CRYO RE-   |
|COMPRESSOR AFTER CRYO                                                      GENERATION |
|1 REGEN-   REGEN                                                           FAULT      |
|ERATION    CRYO 1                                                          COMPRESSOR |
|PROGRAM    2 HOUR                                                          1          |
|CYRGN1     PDM1                                                            CRFLT1     |
|   B3        T4:41                                                            B3      |
|---] [-------] [-------------------------------------------------------------( )------|
|  321     |    DN                   |                                        331      |
|[25]      |[22]                     |                                                 |
|          |                         | B3/331 - ] [ - File #3 CRYO_REGEN - 25          |
|          |                         |            File #6 TECH_RUNGS - 16            |
|          |HIVAC 1                  |                                                 |
|          |10 SEC                   |                                                 |
|          |TIMER                    |                                                 |
|          |COMPLETE                 |                                                 |
|          |CR1FLT                   |                                                 |
|          |  T4:11                  |                                                 |
|          |---] [-------------------|                                                 |
|          |    DN                   |                                                 |
|          |[29]                     |                                                 |
|          |PURGE TIMER              |                                                 |
|          |MONITOR                  |                                                 |
|          |CRYO 1        N2 FLOW SWITCH                                               |
|          |5SEC TEST     1          |                                                 |
|          |PGC1                     |                                                 |
|          | +-GEQ-------------+  I:002                                                |
|          |-+GRTR THAN OR EQUAL (A>=B)+----]/[----|                                   |
|          | |SOURCE A:     T4:21.ACC|    00       |                                   |
|          | |                     0|             |                                   |
|          | |SOURCE B:             5|            |                                    |
|          | |                      5|            |                                    |
|          | +----------------------+            |                                    |
|          |T4:21.ACC - [9]          |                                                 |
|          |PIRANI                   |                                                 |
|          |GUAGE 2                  |                                                 |
|          |NO FAULT                 |                                                 |
|          |PGNF2                    |                                                 |
|          |  I:004                  |                                                 |
|          |---]/[-------------------|                                                 |
|              15                                                                      |
```

Rung #031

```
|                   REPURGE
|                   COMPRESSOR                                                      CRYO REGEN
|                   1 TIMER                                                         ROUGHING
|NO CRYOS BEING     DONE                                                            TIMEOUT
|REGENERATED        5 MINUTE                                                        CR_RUFF_TIME
|NO_CYRGN           CR1RUF_TMR                                                          83
|     83               T4:171
|----]/[------------+----] [------+-------------------------------------------------( )----|
|    233            |     DN      |                                                    818
|[33]               |[15]         |
|                   |             | 83/818 - ] [ - File #2 MAIN_PRGRM - 624
|                   |EXCESS       |
|                   |ROUGHING     |
|                   |TIME         |
|                   |CRYOPUMP 2   |
|                   |CR2RUF_TMR   |
|                   |   T4:172    |
|                   |----] [------|
|                   |     DN      |
|                   |[164]        |
|                   |REPURGE      |
|                   |COMPRESSOR   |
|                   |3 TIMER      |
|                   |DONE         |
|                   |5 MINUTE     |
|                   |CR3RUF_TMR   |
|                   |   T4:173    |
|                   |----] [------|
|                   |     DN      |
|                   |[165]        |
|                   |REPURGE      |
|                   |COMPRESSOR   |
|                   |4 TIMER      |
|                   |DONE         |
|                   |5 MINUTE     |
|                   |CR4RUF_TMR   |
|                   |   T4:174    |
|                   |----] [------|
|                   |     DN      |
|                   |[167]        |
|                   |REPURGE      |
|                   |COMPRESSOR   |
|                   |5 TIMER      |
|                   |DONE         |
|                   |5 MINUTE     |
|                   |CR5RUF_TMR   |
|                   |   T4:175    |
|                   |----] [------|
|                   |     DN      |
|                   |[166]        |
|                   |REPURGE      |
|                   |COMPRESSOR   |
|                   |6 TIMER      |
|                   |DONE         |
|                   |5 MINUTE     |
|                   |CR6RUF_TMR   |
|                   |   T4:176    |
|                   |----] [------|
|                   |     DN      |
|                   |[168]        |
|                   |REPURGE      |
|                   |COMPRESSOR   |
>                   >             >                                                          >
```

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```
<                  <             <
|                  |7 TIMER      |
|                  |DONE         |
|                  |5 MINUTE     |
|                  |CR7RUF_TMR   |
|                  |   T4:177    |
|                  |----] [------|
|                  |     DN      |
|                  |[169]        |
|                  |CR8RUF_TMR   |
|                  |   T4:178    |
|                  |----] [------|
|                  |     DN      |
|                  |[170]        |
|                  |CR9RUF_TMR   |
|                  |   T4:179    |
|                  |----] [------|
|                  |     DN      |
|                  |[171]        |
|                  |CR10RUF_TMR  |
|                  |   T4:180    |
|                  |-----] [-----|
|                  |      DN     |
|                  |[172]        |
|                  |CR11RUF_TMR  |
|                  |   T4:181    |
|                  |-----] [-----|
|                  |      DN     |
|                  |[174]        |
```

480

Rung #032

```
|                   COOL DOWN                                                             |
|                   AFTER CRYO                                                            |
|                   REGEN                                                    CRYO REGEN   |
|NO CRYOS BEING     CRYO 1                                                   COOL DOWN    |
|REGENERATED        2 HOUR                                                   >2 HOURS     |
|NO_CYRGN           PDM1                                                     CR_CD>2H     |
|     B3              T4:41                                                     B3        |
|-----]/[-------+-----] [-----+---------------------------------------------------( )-----|
|    233        |      DN     |                                                 820       |
|[33]           |[22]         |                                                           |
|               |             | B3/820 - ] [ - File #2 MAIN_PRGRM - 624                   |
|               |COOL DOWN    |                                                           |
|               |AFTER CRYO   |                                                           |
|               |REGEN        |                                                           |
|               |CRYO 2       |                                                           |
|               |2 HOUR       |                                                           |
|               |PDM2         |                                                           |
|               |   T4:42     |                                                           |
|               |-----] [-----|                                                           |
|               |      DN     |                                                           |
|               |[217]        |                                                           |
|               |PUMPDOWN     |                                                           |
|               |AFTER CRYO   |                                                           |
|               |REGEN        |                                                           |
|               |COMPRESSOR   |                                                           |
|               |3  2 HOUR    |                                                           |
|               |PDM3         |                                                           |
|               |   T4:43     |                                                           |
|               |-----] [-----|                                                           |
|               |      DN     |                                                           |
|               |[218]        |                                                           |
|               |PUMPDOWN     |                                                           |
|               |AFTER CRYO   |                                                           |
|               |REGEN        |                                                           |
|               |COMPRESSOR   |                                                           |
|               |4  2 HOUR    |                                                           |
|               |PDM4         |                                                           |
|               |   T4:44     |                                                           |
|               |-----] [-----|                                                           |
|               |      DN     |                                                           |
|               |[219]        |                                                           |
|               |PUMPDOWN     |                                                           |
|               |AFTER CRYO   |                                                           |
|               |REGEN        |                                                           |
|               |COMPRESSOR   |                                                           |
|               |5  2 HOUR    |                                                           |
|               |PDM5         |                                                           |
|               |   T4:45     |                                                           |
|               |-----] [-----|                                                           |
|               |      DN     |                                                           |
|               |[220]        |                                                           |
|               |PUMPDOWN     |                                                           |
|               |AFTER CRYO   |                                                           |
|               |REGEN        |                                                           |
|               |COMPRESSOR   |                                                           |
|               |6  2 HOUR    |                                                           |
|               |PDM6         |                                                           |
|               |   T4:46     |                                                           |
|               |-----] [-----|                                                           |
|               |      DN     |                                                           |
|               |[221]        |                                                           |
|               |PUMPDOWN     |                                                           |
>               >             >                                                           >
```

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```
|AFTER CRYO
|REGEN
|COMPRESSOR
|7  2 HOUR
|PDN7
|   T4:47
|---] [---
|    DN
|[222]
|PUMPDOWN
|AFTER CRYO
|REGEN
|COMPRESSOR
|8  2 HOUR
|PDN8
|   T4:48
|---] [---
|    DN
[223]
```

Rung #033

```
|COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR
|1 REGEN-    2 REGEN-    3 REGEN-    4 REGEN-    5 REGEN-    6 REGEN-    7 REGEN-    8 REGEN-
|ERATION     ERATION     ERATION     ERATION     ERATION     ERATION     ERATION     ERATION      NO CRYOS BEING
|PROGRAM     PROGRAM     PROGRAM     PROGRAM     PROGRAM     PROGRAM     PROGRAM     PROGRAM      REGENERATED
|CYRGN1      CYRGN2      CYRGN3      CYRGN4      CYRGN5      CYRGN6      CYRGN7      CYRGN8       NO_CYRGN
   B3          B3          B3          B3          B3          B3          B3          B3              B3
---]/[-------]/[---------]/[---------]/[---------]/[---------]/[---------]/[---------]/[-----------( )---
   321         322         323         324         325         326         327         328            233
|[25]        [34]        [38]        [42]        [46]        [52]        [57]        [63]
B3/233 - ] [ - File #2 MAIN_PRGRM - 23,91
         ]/[ - File #2 MAIN_PRGRM - 91
               File #3 CRYO_REGEN - 31,32
         -( )- - File #3 CRYO_REGEN - 33
```

Rung #034

```
|                                                                          COMPRESSOR
|                                                                          2 REGEN-
| REGENERATE             ABORT CRYO                                        ERATION
| CRYO 2                 TIMER                                             PROGRAM
| TS02                   ABORTCRYO                                         CYRGN2
|   N7:15                  T4:297                                            B3
|----] [-----------------+---]/[------------------------------------------+---(L)---
| |   10                 |    TT                                          |   322
| |[2:3]                 | [27]                                           |
| |                      |                                                |MANUAL
| |                      | B3/322 - ] [ - File #2 MAIN_PRGRM - 110, 117, 118, 460, 462   |COMPRESSOR 2
| |                      |                File #3 CRYO_REGEN - 35, 37, 67, 74, 210, 245, 252,   |REGENERATION
| |                      |                259                             |ENABLE
| |                      |                File #6 TECH_RUNGS - 14         |MC2RE
| |                      |          ]/[ - File #2 MAIN_PRGRM - 27, 117, 118   |   N7:36
| |HI_STAG               |                File #3 CRYO_REGEN - 33, 117, 135, 143, 176, 210, 224,   +---(L)---
| |+-GEQ-------------+   |                231                                  10
| +|GRTR THAN OR EQUAL (A>=B)|-+          -(U)- - File #3 CRYO_REGEN - 238
|  |SOURCE A:     T4:197.ACC|   N7:36/10 - -(U)- - File #3 CRYO_REGEN - 238
|  |                       0|   _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
|  |SOURCE B:              5|
|  |                       5|
|  +------------------------+
| T4:197.ACC - [2:20]
```

```
Rung #035
|COMPRESSOR  HEATER 2
|2 REGEN-    CHAMBER
|ERATION     GATE VALVE                                                       REGEN COMP. 2
|PROGRAM     CLOSE                                                            PULSE TIMER
|CYRGN2      HV2S1                                                            CR2PT
|   B3         I:004                                                          +-TON------------------+
|---] [--------] [------------------------------------------------------------+TIMER ON DELAY        +-(EN)-
|   322        00                                                             |TIMER:         T4:62  |
|[34]                                                                         |BASE (SEC):     1.0   +-(DN)
|                                                                             |PRESET:           1   |
| T4:62.TT - ] [ - File #3 CRYO_REGEN - 74, 81, 88                            |ACCUM:            0   |
| T4:342.ACC - LEQ - File #3 CRYO_REGEN - 37                                  +----------------------+
| T4:342.TT - ] [ - File #3 CRYO_REGEN - 36, 263
|             ]/[ - File #3 CRYO_REGEN - 264                                  SIEVE TRAP
|                                                                             2 TIMER
|                                                                             S_TRAP_2
|                                                                             +-TON------------------+
|                                                                             +TIMER ON DELAY        +-(EN)-
|                                                                             |TIMER:        T4:342  |
|                                                                             |BASE (SEC):     1.0   +-(DN)
|                                                                             |PRESET:        5400   |
|                                                                             |ACCUM:            0   |
|                                                                             +----------------------+
Rung #036
|                    MECHANICAL
|                    PUMP 2                                                        SIEVE TRAP
|                    ISOLATION                                                     ISOLATION VALVE
|                    VALVE OPEN                                                    2
|  S_TRAP_2          MP2IVOP                                                       SVIV2
|   T4:342            I:025                                                          O:010
|----] [------+--------] [-------------------------------------------------------------( )--
| |    TT     |         13                                                              01
| |[35]       |
| |           | O:010/01 - ] [ - File #3 CRYO_REGEN - 37
| |OPEN       |
| |CRYO ROUGH |
| |VALVE 2    |
| |CR2        |
| |   O:007   |
| +----] [----+
|       12
| [164]
Rung #037
|COMPRESSOR
|2 REGEN-                          SIEVE TRAP                                       SIEVE TRAP
|ERATION                           ISOLATION VALVE                                  HEATER 2
|PROGRAM                           2                                                SVHTR2
|CYRGN2     S_TRAP_2               SVIV2                                              O:010
|  B3       +-LEQ---------------------+   O:010
|---] [-----+LESS THAN OR EQUAL (A<=B)+----] [------------------------------------------( )--
|  322      |SOURCE A:      T4:342.ACC|     01                                           14
|[34]       |                        0| [36]
|           |SOURCE B:            3600|
|           |                     3600|
|           +-------------------------+
|           T4:342.ACC - [35]
```

```
Rung #038
|                                                                                       COMPRESSOR
|                                                                                       3 REGEN-
| REGENERATE                 ABORT CRYO                                                 ERATION
| CRYO 3                     TIMER                                                      PROGRAM
| TS03                       ABORTCRYO                                                  CYRGN3
|   N7:15                      T4:297                                                      B3
|---] [----------------------]/[---------------------------------------------------------(L)---
| |   11                     |  TT                                                         323
| |[2:3]                     |[27]
| |                          |                                                          |MANUAL
| |                          | B3/323 - ] [ - File #2 MAIN_PRGRM - 111, 119, 120, 464, 466  |COMPRESSOR 3
| |                          |            File #3 CRYO_REGEN - 39, 41, 68, 75, 211, 246, 253, |REGENERATION
| |                          |            259                                               |ENABLE
| |                          |            File #6 TECH_RUNGS - 14                           |MC3RE
| |                          |        ]/[ - File #2 MAIN_PRGRM - 28, 119, 120               |  N7:36
| |HI_STAG                   |            File #3 CRYO_REGEN - 33, 118, 136, 145, 178, 211, 225,  ---(L)---
| |--GEQ------------------   |            232                                                    11
|-|GRTR THAN OR EQUAL (A>=B)|-        -(U)- - File #3 CRYO_REGEN - 239
| |SOURCE A:     T4:197.ACC|   N7:36/11 - -(U)- - File #3 CRYO_REGEN - 239
| |                       0|   _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
| |SOURCE B:             10|
| |                      10|
|  -------------------------
| T4:197.ACC - [2:20]
Rung #039
 MPRESSOR  DWELL 1
 REGEN-    CHAMBER
|ERATION   GATE VALVE                                               REGEN COMP. 3
|PROGRAM   CLOSED                                                   PULSE TIMER
|CYRGN3    HV3S1                                                    CR3PT
|   B3      I:004                                                   --TON-----------------
|---] [-------] [---------------------------------------------------|TIMER ON DELAY      |-(EN)-
|   323        03                                                   |TIMER:        T4:63|
|[38]                                                               |BASE (SEC):    1.0|-(DN)
|                                                                   |PRESET:           1|
| T4:63.TT - ] [ - File #3 CRYO_REGEN - 75, 82, 89                  |ACCUM:            0|
| T4:343.ACC - LEQ - File #3 CRYO_REGEN - 41                        ----------------------
| T4:343.TT - ] [ - File #3 CRYO_REGEN - 40, 263
|            ]/[ - File #3 CRYO_REGEN - 264
|                                                                   |SIEVE TRAP
|                                                                   |3 TIMER
|                                                                   |S_TRAP_3
|                                                                   --TON-----------------
|                                                                   |TIMER ON DELAY      |-(EN)-
|                                                                   |TIMER:       T4:343|
|                                                                   |BASE (SEC):    1.0|-(DN)
|                                                                   |PRESET:        5400|
|                                                                   |ACCUM:            0|
|                                                                   ----------------------
```

Rung #040

```
S_TRAP_3 T4:343 TT [39]
MECHANICAL PUMP 2 ISOLATION VALVE OPEN MP2IVOP I:025 13
SIEVE TRAP ISOLATION VALVE 3 SVIV3 O:011 ( ) 17
O:011/17 - -| |- - File #3 CRYO_REGEN - 41
OPEN CRYO ROUGH VALVE 3 CR3 O:007 13 [165]
```

Rung #041

```
COMPRESSOR 3 REGEN-ERATION PROGRAM CYRGN3 B3 323 [38]
S_TRAP_3
LEQ
LESS THAN OR EQUAL (A<=B)
SOURCE A:      T4:343.ACC
                        0
SOURCE B:            3600
                     3600
T4:343.ACC - [39]
SIEVE TRAP ISOLATION VALVE 3 SVIV3 O:011 17 [40]
SIEVE TRAP HEATER 3 SVHTR3 O:010 ( ) 15
```

Rung #042

```
REGENERATE CRYO 4 TS04 N7:15 12 [2:3]
ABORT CRYO TIMER ABORTCRYO T4:297 -|/|- TT [27]
COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4 B3 (L) 324
MANUAL COMPRESSOR 4 REGENERATION ENABLE MC4RE N7:36 (L) 12

B3/324 - -| |- - File #2 MAIN_PRGRM - 111, 123, 124, 470, 472, 474
                  File #3 CRYO_REGEN - 43, 45, 69, 76, 212, 247, 254,
                  259
                  File #6 TECH_RUNGS - 14
            -|/|- - File #2 MAIN_PRGRM - 29, 123, 124
                  File #3 CRYO_REGEN - 33, 119, 137, 149, 180, 212, 226,
                  233
            -(U)- - File #3 CRYO_REGEN - 240
N7:36/12 - -(U)- - File #3 CRYO_REGEN - 240
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

HI_STAG
GEQ
GRTR THAN OR EQUAL (A>=B)
SOURCE A:      T4:197.ACC
                        0
SOURCE B:              15
                       15
T4:197.ACC - [2:20]
```

```
Rung #043
|COMPRESSOR  HEATER 3
|4 REGEN-    CHAMBER
|ERATION     GATE VALVE                                                      REGEN COMP. 4
|PROGRAM     CLOSED                                                          PULSE TIMER
|CYRGN4      HVSS1                                                           CR4PT
|    B3       I:024                                                          +-TON-----------------+
|---] [--------] [-----------------------------------------------------------+|TIMER ON DELAY      |-(EN)-+-|
|   324        00                                                           ||TIMER:         T4:64|      |
|[42]                                                                       ||BASE (SEC):      1.0|-(DN) |
|                                                                           ||PRESET:            1|      |
| T4:64.TT - ] [ - File #3 CRYO_REGEN - 76, 83, 90                          ||ACCUM:             0|      |
| T4:344.ACC - LEQ - File #3 CRYO_REGEN - 45                                |+--------------------+      |
| T4:344.TT - ] [ - File #3 CRYO_REGEN - 44, 263                            |                            |
|             ]/[ - File #3 CRYO_REGEN - 264                                |                            |
|                                                                           |SIEVE TRAP                  |
|                                                                           |4 TIMER                     |
|                                                                           |S_TRAP_4                    |
|                                                                           |+-TON-----------------+     |
|                                                                           +|TIMER ON DELAY      |-(EN)-+
|                                                                            |TIMER:        T4:344|
|                                                                            |BASE (SEC):      1.0|-(DN)
|                                                                            |PRESET:         5400|
|                                                                            |ACCUM:             0|
|                                                                            +--------------------+

Rung #044
|                MECHANICAL
|                PUMP 2                                                        SIEVE TRAP
|                ISOLATION                                                     ISOLATION VALVE
|                VALVE OPEN                                                    5
| S_TRAP_4       MP2IVOP                                                       SVIV5
|   T4:344        I:025                                                          O:031
|-+--] [--+--------] [-------------------------------------------------------------( )-----|
| |   TT   |        13                                                             05
| |[43]    |
| |        | O:031/05 - ] [ - File #3 CRYO_REGEN - 45
| |OPEN    |
| |CRYO ROUGH
| |VALVE 5 |
| |CR5     |
| |  O:027 |
| +--] [---+
|     12
| [166]

Rung #045
|COMPRESSOR
|4 REGEN-                  SIEVE TRAP
|ERATION                   ISOLATION VALVE                                     SIEVE TRAP
|PROGRAM                   5                                                   HEATER 5
|CYRGN4    S_TRAP_4        SVIV5                                               SVHTR5
|    B3    +-LEQ------------------------+   O:031                                O:027
|---] [----|LESS THAN OR EQUAL (A<=B)   |----] [----------------------------------( )-----|
|   324    |SOURCE A:        T4:344.ACC|     05                                   15
|[42]      |                          0|  [44]
|          |SOURCE B:              3600|
|          |                       3600|
|          +---------------------------+
|          T4:344.ACC - [43]
```

```
Rung #046
|                                                                                              COMPRESSOR  |
|                                                                                              5 REGEN-    |
| REGENERATE              ABORT CRYO                                                           ERATION     |
| CRYO 5                  TIMER                                                                PROGRAM     |
| TS05                    ABORTCRYO                                                            CYRGN5      |
|    N7:15                  T4:297                                                                B3       |
|-+--| |---------------+----|/|-------------------------------------------------------------+----(L)----+-|
| |   13              |      TT                                                            |    325    | |
| |[2:3]              |[27]                                                                |           | |
| |                   |                                                                    |MANUAL     | |
| |                   |B3/325 - -| |- - File #2 MAIN_PRGRM - 111, 112, 121, 122, 125, 126, 127, |COMPRESSOR 5| |
| |                   |         128, 468, 476, 478, 480, 482                               |REGENERATION| |
| |                   |         File #3 CRYO_REGEN - 47, 51, 70, 77, 213, 248, 255,        |ENABLE     | |
| |                   |         259                                                        |MC5RE      | |
| |                   |         File #6 TECH_RUNGS - 14                                    |   N7:36   | |
| |HI_STAG            |  -|/|- - File #2 MAIN_PRGRM - 30, 121, 122, 125, 126, 127, 128     +----(L)----+ |
| |+-GEQ-------------+|         File #3 CRYO_REGEN - 33, 120, 121, 122, 138, 147, 151,          13        |
| +|GRTR THAN OR EQUAL (A>=B)|-+  153, 182, 213, 227, 234                                                 |
|  |SOURCE A:    T4:197.ACC|    -(U)- - File #3 CRYO_REGEN - 241                                         |
|  |                      0|  N7:36/13 - -(U)- - File #3 CRYO_REGEN - 241                                |
|  |SOURCE B:            20|  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                |
|  |                     20|                                                                             |
|  +-----------------------+                                                                             |
| T4:197.ACC - [2:20]                                                                                    |
Rung #047
| PRESSOR  DWELL 2     DWELL 3     DWELL 4                                                               |
|  REGEN-  CHAMBER     CHAMBER     CHAMBER                                                               |
|ERATION   GATE VALVE  GATE VALVE  GATE VALVE                         REGEN COMP. 5                      |
|PROGRAM   CLOSED      CLOSED      CLOSED                             PULSE TIMER                        |
|CYRGN5    HV4S1       HV6S1       HV7S1                              CR5PT                              |
|   B3       I:022       I:024       I:036                            +-TON-----------------+            |
|---| |--------| |---------| |---------| |--------------------------+-|TIMER ON DELAY       |-(EN)-+----|
|   325          06          03          06                         | |TIMER:        T4:65 |      |    |
|[46]                                                               | |BASE (SEC):     1.0 |-(DN) |    |
|                                                                   | |PRESET:          65 |      |    |
| T4:65.TT - -| |- - File #3 CRYO_REGEN - 77, 84, 91, 92, 93        | |ACCUM:            0 |      |    |
| T4:345.ACC - LEQ - File #3 CRYO_REGEN - 51                        | +--------------------+      |    |
| T4:345.TT - -| |- - File #3 CRYO_REGEN - 48, 49, 50, 263          |                             |    |
|             -|/|- - File #3 CRYO_REGEN - 264                      |                             |    |
|                                                                   |SIEVE TRAP                   |    |
|                                                                   |5 TIMER                      |    |
|                                                                   |S_TRAP_5                     |    |
|                                                                   | +-TON----------------+      |    |
|                                                                   +-|TIMER ON DELAY      |-(EN)-+    |
|                                                                     |TIMER:      T4:345  |           |
|                                                                     |BASE (SEC):    1.0  |-(DN)      |
|                                                                     |PRESET:       5400  |           |
|                                                                     |ACCUM:           0  |           |
|                                                                     +--------------------+           |
```

Rung #048

```
                 MECHANICAL
                 PUMP 2
                 ISOLATION                               SIEVE TRAP
                 VALVE OPEN                              ISOLATION VALVE
  S_TRAP_5       MP2IVOP                                 4
   T4:345         I:025                                  SVIV4
                                                             O:031
|--+--] [--+------] [-----------------------------------------( )----|
|  |   TT  |       13                                          04
|  |[47]   |
|  |       | O:031/04 - ] [ - File #3 CRYO_REGEN - 51
|  |OPEN   |
|  |CRYO ROUGH
|  |VALVE 4|
|  |CR4    |
|  |  O:027|
|  +--] [--+
|      11
|  [167]
```

Rung #049

```
                 MECHANICAL
                 PUMP 2
                 ISOLATION                               SIEVE TRAP
                 VALVE OPEN                              ISOLATION VALVE
  S_TRAP_5       MP2IVOP                                 6
   T4:345         I:025                                  SVIV6
                                                             O:031
|--+--] [--+------] [-----------------------------------------( )----|
|  |   TT  |       13                                          06
|  |[47]   |
|  |       | O:031/06 - ] [ - File #3 CRYO_REGEN - 51
|  |OPEN   |
|  |CRYO ROUGH
|  |VALVE 6|
|  |CR6    |
|  |  O:027|
|  +--] [--+
|      13
|  [168]
```

Rung #050

```
                 MECHANICAL
                 PUMP 2
                 ISOLATION                               SIEVE TRAP
                 VALVE OPEN                              ISOLATION VALVE
  S_TRAP_5       MP2IVOP                                 7
   T4:345         I:025                                  SVIV7
                                                             O:031
|--+--] [--+------] [-----------------------------------------( )----|
|  |   TT  |       13                                          07
|  |[47]   |
|  |       | O:031/07 - ] [ - File #3 CRYO_REGEN - 51
|  |OPEN   |
|  |CRYO ROUGH
|  |VALVE 7|
|  |CR7    |
|  |  O:043|
|  +--] [--+
|      11
|  [169]
```

Rung #051

```
|COMPRESSOR
|5 REGEN-                                                  SIEVE TRAP
|ERATION                                                   ISOLATION VALVE  SIEVE TRAP
|PROGRAM                                                   4                HEATER 4
|CYRGN5       S_TRAP_5                                     SVIV4            SVHTR4
|   B3       ┌─LEQ──────────────────────┐                      0:031           0:027
├───┤ ├──────┤LESS THAN OR EQUAL (A<=B) ├──────────────────┬──────┤ ├───────────( )──────┬─┤
|   325      |SOURCE A:      T4:345.ACC|                   |      04             14      |
|[46]        |                        0|                   |[48]                         |
|            |SOURCE B:            3600|                   |                             |
|            |                     3600|                   |                             |
|            └─────────────────────────┘                   |                             |
|            T4:345.ACC - [47]                             |SIEVE TRAP                   |
|                                                          |ISOLATION VALVE  SIEVE TRAP  |
|                                                          |6                HEATER 6    |
|                                                          |SVIV6            SVHTR6      |
|                                                          |     0:031          0:027    |
|                                                          ├──────┤ ├───────────( )──────┤
|                                                          |      06             17      |
|                                                          |[49]                         |
|                                                          |SIEVE TRAP                   |
|                                                          |ISOLATION VALVE  SIEVE TRAP  |
|                                                          |7                HEATER 7    |
|                                                          |SVIV7            SVHTR7      |
|                                                          |     0:031          0:030    |
|                                                          └──────┤ ├───────────( )──────┘
|                                                                 07             12
|                                                          [50]
```

Rung #052

```
|                                                                         COMPRESSOR
|                                                                         6 REGEN-
| REGENERATE                ABORT CRYO                                    ERATION
| CRYO 6                    TIMER                                         PROGRAM
| TS06                      ABORTCRYO                                     CYRGN6
|   N7:15                     T4:297                                         B3
├─┬───┤ ├────────────────┬──────┤/├───────────────────────────────────┬──────(L)──────┬─┤
| |   14                 |      TT                                    |      326      |
| |[2:3]                 | [27]                                       |               |
| |                      |                                            |MANUAL         |
| |                      | B3/326 - ┤ ├ - File #2 MAIN_PRGRM - 112, 129, 130, 484, 486  |COMPRESSOR 6   |
| |                      |                File #3 CRYO_REGEN - 54, 56, 71, 78, 214, 249, 256, |REGENERATION |
| |                      |                259                         |ENABLE         |
| |                      |                File #6 TECH_RUNGS - 14     |MC6RE          |
| |                      |          ┤/├ - File #2 MAIN_PRGRM - 31, 129, 130  |   N7:36  |
| |HI_STAG               |                File #3 CRYO_REGEN - 33, 123, 139, 155, 184, 214, 228, └──(L)──┘
| |┌─GEQ──────────────────┐|               235                                 14
| └┤GRTR THAN OR EQUAL (A>=B)├┘
|  |SOURCE A:    T4:197.ACC|         -(L)- - File #3 CRYO_REGEN - 53
|  |                      0|         -(U)- - File #3 CRYO_REGEN - 242
|  |SOURCE B:            25| N7:36/14 - -(L)- - File #3 CRYO_REGEN - 53
|  |                     25|            -(U)- - File #3 CRYO_REGEN - 242
|  └───────────────────────┘ _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2
|  T4:197.ACC - [2:20]
```

```
Rung #053
                                                                                         COMPRESSOR
                                                                                         6 REGEN-
 REGENERATE                    ABORT CRYO                                                ERATION
 CRYO 6                        TIMER                                                     PROGRAM
 TS06                          ABORTCRYO                                                 CYRGN6
   N7:15                         T4:297                                                    B3
|--| |-------------------------|--|/|------------------------------------------------------(L)---|
    14                             TT                                                     326
 [2:3]                          [27]
                                                                                         MANUAL
                               B3/326 - -| |- - File #2 MAIN_PRGRM - 112, 129, 130, 484, 486     COMPRESSOR 6
                                                File #3 CRYO_REGEN - 54, 56, 71, 78, 214, 249, 256,   REGENERATION
                                                259                                      ENABLE
                                                File #6 TECH_RUNGS - 14                  MC6RE
                                        -|/|- - File #2 MAIN_PRGRM - 31, 129, 130          N7:36
 HI_STAG                                        File #3 CRYO_REGEN - 33, 123, 139, 155, 184, 214, 228,  -(L)-
 GEQ                                            235                                        14
 GRTR THAN OR EQUAL (A>=B)              -(L)- - File #3 CRYO_REGEN - 52
 SOURCE A:        T4:197.ACC            -(U)- - File #3 CRYO_REGEN - 242
                           0   N7:36/14 - -(L)- - File #3 CRYO_REGEN - 52
 SOURCE B:                25              -(U)- - File #3 CRYO_REGEN - 242
                          25   _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

 T4:197.ACC - [2:20]
Rung #054
 MPRESSOR  BUFFER 3
 6 REGEN-  CHAMBER
 ERATION   GATE VALVE                                              REGEN COMP. 6
 PROGRAM   CLOSED                                                  PULSE TIMER
 CYRGN6    HV8S1                                                   CR6PT
   B3        I:040                                                 TON
|--| |--------| |--------------------------------------------------TIMER ON DELAY  -(EN)-
   326        00                                                   TIMER:      T4:66
 [53]                                                              BASE (SEC):   1.0 -(DN)
                                                                   PRESET:         1
 T4:66.TT - -| |- - File #3 CRYO_REGEN - 78, 85, 94                ACCUM:          0
 T4:346.ACC - LEQ - File #3 CRYO_REGEN - 56
 T4:346.TT - -| |- - File #3 CRYO_REGEN - 55, 263
             -|/|- - File #3 CRYO_REGEN - 264
                                                                   SIEVE TRAP
                                                                   6 TIMER
                                                                   S_TRAP_6
                                                                   TON
                                                                   TIMER ON DELAY  -(EN)-
                                                                   TIMER:     T4:346
                                                                   BASE (SEC):   1.0 -(DN)
                                                                   PRESET:      5400
                                                                   ACCUM:          0
```

491

```
Rung #055
|               MECHANICAL
|               PUMP 2                                                                SIEVE TRAP         |
|               ISOLATION                                                             ISOLATION VALVE    |
|               VALVE OPEN                                                            8                  |
|  S_TRAP_6     MP2IVOP                                                               SVIV8              |
|   T4:346        I:025                                                                   0:031          |
|-+--] [--+------] [--------------------------------------------------------------------( )-------------|
| |   TT    |      13                                                                       10           |
| |[54]     |                                                                                            |
| |         | 0:031/10 - ] [ - File #3 CRYO_REGEN - 56                                                   |
| |OPEN     |                                                                                            |
| |CRYO ROUGH                                                                                            |
| |VALVE 8  |                                                                                            |
| |CR8      |                                                                                            |
| |  0:043  |                                                                                            |
| +--] [----+                                                                                            |
|     12                                                                                                 |
|  [170]                                                                                                 |
Rung #056
|COMPRESSOR
|6 REGEN-                                                                                                |
|ERATION                       SIEVE TRAP                                                                |
|PROGRAM                       ISOLATION VALVE                                    SIEVE TRAP             |
|CYRGN6     S_TRAP_6           8                                                  HEATER 8               |
|  B3       +-LEQ---------------------+    SVIV8                                  SVHTR8                 |
|           |                         |      0:031                                   0:031              |
|--] [------+LESS THAN OR EQUAL (A<=B)+-------] [-------------------------------------( )---------------|
|  326      |SOURCE A:     T4:346.ACC|        10                                        17               |
|[53]       |                       0|  [55]                                                             |
|           |SOURCE B:           3600|                                                                   |
|           |                    3600|                                                                   |
|           +-------------------------+                                                                  |
|           T4:346.ACC - [54]                                                                            |
Rung #057
|                                                                             COMPRESSOR                 |
|                                                                             7 REGEN-                   |
|  REGENERATE                  ABORT CRYO                                     ERATION                    |
|  CRYO 7                      TIMER                                          PROGRAM                    |
|  TS07                        ABORTCRYO                                      CYRGN7                     |
|    N7:15                       T4:297                                           B3                     |
|-+--] [---------------------+----]/[---------------------------------------+----(L)-------+-----------|
| |   15                     |    TT                                        |    327       |           |
| |[2:3]                     | [27]                                       |              |           |
| |                          |                                            |MANUAL        |           |
| |                          | B3/327 - ] [ - File #2 MAIN_PRGRM - 113, 114, 131, 132, 133, 134, 137,   |
| |                          |                138, 488, 490, 492, 494, 500, 502   |COMPRESSOR 7  |           |
| |                          |                File #3 CRYO_REGEN - 58, 62, 72, 79, 215, 250, 257,      |
| |                          |                259                         |REGENERATION  |           |
| |                          |                File #6 TECH_RUNGS - 14     |ENABLE        |           |
| |HI_STAG                   |          ]/[ - File #2 MAIN_PRGRM - 32, 131, 132, 133, 134, 137, 138     |
| |+-GEQ--------------------+|                File #3 CRYO_REGEN - 33, 124, 125, 126, 140, 157, 159,   |
| +|GRTR THAN OR EQUAL (A>=B)|+               163, 186, 215, 229, 236     |MC7RE         |           |
|  |SOURCE A:     T4:197.ACC|          -(U)- - File #3 CRYO_REGEN - 243   |   N7:36      |           |
|  |                       0|  N7:36/15 - -(U)- - File #3 CRYO_REGEN - 243 +----(L)-------+           |
|  |SOURCE B:             30|  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2       15                    |
|  |                      30|                                                                          |
|  +------------------------+                                                                          |
|  T4:197.ACC - [2:20]                                                                                  |
```

```
Rung #058
|COMPRESSOR  DWELL 5     DWELL 6     EXITLOCK                                                    |
|7 REGEN-    CHAMBER     CHAMBER     CHAMBER                                                     |
|ERATION     GATE VALVE  GATE VALVE  GATE VALVE                              REGEN COMP. 7       |
|PROGRAM     CLOSED      CLOSED      CLOSED                                  PULSE TIMER         |
|CYRGN7      HV9S1       HV10S1      HV12S1                                  CR7PT               |
|    B3        I:040       I:052       I:054                                 +-TON-------------+ |
|----] [-------] [---------] [---------] [-----------------------------------+TIMER ON DELAY   +-(EN)-+-
|   327         03          06          03                                  ||TIMER:     T4:67| |   |
|[57]                                                                       ||BASE (SEC):  1.0+-(DN)|
|                                                                           ||PRESET:        1| |   |
| T4:67.TT - ] [ - File #3 CRYO_REGEN - 79, 86, 95, 96, 97                  ||ACCUM:         0| |   |
| T4:347.ACC - LEQ - File #3 CRYO_REGEN - 62                                |+-----------------+ |   |
| T4:347.TT - ] [ - File #3 CRYO_REGEN - 59, 60, 61, 263                    |                    |   |
|             ]/[ - File #3 CRYO_REGEN - 264                                |                    |   |
|                                                                           |SIEVE TRAP          |   |
|                                                                           |7 TIMER             |   |
|                                                                           |S_TRAP_7            |   |
|                                                                           | +-TON------------+ |   |
|                                                                           +-TIMER ON DELAY   +-(EN)-+
|                                                                            |TIMER:    T4:347|      |
|                                                                            |BASE (SEC):  1.0+-(DN) |
|                                                                            |PRESET:     5400|      |
|                                                                            |ACCUM:         0|      |
|                                                                            +----------------+      |
Rung #059
|                 MECHANICAL                                                                  |
|                 PUMP 2                                                       SIEVE TRAP      |
|                 ISOLATION                                                    ISOLATION VALVE |
|                 VALVE OPEN                                                   9               |
|  S_TRAP_7      MP2IVOP                                                      SVIV9           |
|   T4:347          I:025                                                         O:045       |
|-+---] [-----+-----] [----------------------------------------------------------( )----------|
| |   TT      |      13                                                           04          |
| |[58]       |                                                                               |
| |           | O:045/04 - ] [ - File #3 CRYO_REGEN - 62                                      |
| |OPEN       |                                                                               |
| |CRYO ROUGH |                                                                               |
| |VALVE 9    |                                                                               |
| |CR9        |                                                                               |
| |   O:043   |                                                                               |
| +---] [-----+                                                                               |
|      13                                                                                     |
| [171]                                                                                       |
Rung #060
|                 MECHANICAL                                                                  |
|                 PUMP 2                                                       SIEVE TRAP      |
|                 ISOLATION                                                    ISOLATION VALVE |
|                 VALVE OPEN                                                   10              |
|  S_TRAP_7      MP2IVOP                                                      SVIV10          |
|   T4:347          I:025                                                         O:045       |
|-+---] [-----+-----] [----------------------------------------------------------( )----------|
| |   TT      |      13                                                           05          |
| |[58]       |                                                                               |
| |           | O:045/05 - ] [ - File #3 CRYO_REGEN - 62                                      |
| |OPEN       |                                                                               |
| |CRYO ROUGH |                                                                               |
| |VALVE 10   |                                                                               |
| |CR10       |                                                                               |
| |   O:057   |                                                                               |
| +---] [-----+                                                                               |
|      11                                                                                     |
| [172]                                                                                       |
```

493

```
Rung #061
|                 MECHANICAL
|                 PUMP 2                                                          SIEVE TRAP          |
|                 ISOLATION                                                       ISOLATION VALVE     |
|                 VALVE OPEN                                                      12                  |
|  S_TRAP_7       MP2IVOP                                                         SVIV12              |
|   T4:347          I:025                                                             O:045           |
|-+---] [---+-------] [-----------------------------------------------------------------( )-----------|
| |    TT   |        13                                                                 07            |
| |[58]     |                                                                                         |
| |         | O:045/07 - ] [ - File #3 CRYO_REGEN - 62                                                |
| |OPEN     |                                                                                         |
| |CRYO ROUGH                                                                                         |
| |VALVE 12 |                                                                                         |
| |CR12     |                                                                                         |
| |  O:057  |                                                                                         |
| +---] [---+                                                                                         |
|      13                                                                                             |
|  [173]                                                                                              |
Rung #062
|COMPRESSOR                                                                                           |
|7 REGEN-                                                           SIEVE TRAP                        |
|ERATION                                                            ISOLATION VALVE  SIEVE TRAP       |
|PROGRAM                                                            9                HEATER 9         |
|CYRGN7      S_TRAP_7                                               SVIV9            SVHTR9           |
|   B3       +-LEQ---------------------+                                O:045           O:043         |
|---] [------+LESS THAN OR EQUAL (A<=B)+------------------------------+---] [----------( )-------+----|
|   327      |SOURCE A:     T4:347.ACC|                               |   04              00      |    |
|[57]        |                       0|                               |[59]                       |    |
|            |SOURCE B:           3600|                               |                           |    |
|            |                    3600|                               |                           |    |
|            +------------------------+                               |                           |    |
|            T4:347.ACC - [58]                                        |SIEVE TRAP                 |    |
|                                                                     |ISOLATION VALVE  SIEVE TRAP|    |
|                                                                     |10               HEATER 10 |    |
|                                                                     |SVIV10           SVHTR10   |    |
|                                                                     |   O:045           O:043   |    |
|                                                                     +---] [-----------( )-------+    |
|                                                                     |   05              01      |    |
|                                                                     |[60]                       |    |
|                                                                     |SIEVE TRAP                 |    |
|                                                                     |ISOLATION VALVE  SIEVE TRAP|    |
|                                                                     |12               HEATER 12 |    |
|                                                                     |SVIV12           SVHTR12   |    |
|                                                                     |   O:045           O:044   |    |
|                                                                     +---] [-----------( )-------+    |
|                                                                         07              02           |
|                                                                     [61]                             |
```

```
Rung #063
|                                                                              COMPRESSOR
|                                                                              8 REGEN-
|                                                                              ERATION
| REGENERATE    ABORT CRYO                                                     PROGRAM
| CRYO 8        TIMER                                                          CYRGN8
| TS08          ABORTCRYO                                                          B3
|   N7:16         T4:297                                                        --(L)--
|----] [------+---]/[--------------------------------------------------------+----------
| |     0     |     TT                                                       |    328
| |[2:3]      | [27]                                                       |
| |           |                                                            |MANUAL
| |           | B3/328 - ] [ - File #2 MAIN_PRGRM - 113, 135, 136, 496, 498 |COMPRESSOR 8
| |           |            File #3 CRYO_REGEN - 64, 66, 73, 80, 216, 251, 258, 259 |REGENERATION
| |           |            File #6 TECH_RUNGS - 14                           |ENABLE
| |           |       ]/[ - File #2 MAIN_PRGRM - 33, 135, 136                |MCBRE
| |           |            File #3 CRYO_REGEN - 33, 127, 141, 161, 188, 216, 230, 237 | N7:37
| |HI_STAG    |       -(U)- - File #3 CRYO_REGEN - 244                     +----(L)----
| | T4:197    | N7:37/0 - -(U)- - File #3 CRYO_REGEN - 244                        0
| +---] [-----+ _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
|      DN
|   [2:20]
Rung #064
|COMPRESSOR  BUFFER 4
|8 REGEN-    CHAMBER                                              REGEN COMP. 8
|ERATION     GATE VALVE                                           PULSE TIMER
|PROGRAM     CLOSED                                               CR8PT
| 'GN8       HV11S1                                               +-TON-----------------+
|   B3         I:054                                             +-+TIMER ON DELAY      +-(EN)-+
|---] [--------] [-----------------------------------------------+ |TIMER:        T4:68|       |
|   328          00                                              | |BASE (SEC):   1.0+-(DN)   |
|[63]                                                            | |PRESET:           1|       |
|                                                                | |ACCUM:            0|       |
| T4:68.TT - ] [ - File #3 CRYO_REGEN - 80, 87, 98               | +--------------------+       |
| T4:348.ACC - LEQ - File #3 CRYO_REGEN - 66                     |                              |
| T4:348.TT - ] [ - File #3 CRYO_REGEN - 65, 263                 |                              |
|             ]/[ - File #3 CRYO_REGEN - 264                     |SIEVE TRAP                    |
|                                                                |8 TIMER                       |
|                                                                |S_TRAP_8                      |
|                                                                | +-TON-----------------+      |
|                                                                +-+TIMER ON DELAY      +-(EN)-+
|                                                                  |TIMER:       T4:348|
|                                                                  |BASE (SEC):   1.0+-(DN)
|                                                                  |PRESET:        5400|
|                                                                  |ACCUM:            0|
|                                                                  +--------------------+
```

Rung #065

```
              MECHANICAL
              PUMP 2                                           SIEVE TRAP
              ISOLATION                                        ISOLATION VALVE
              VALVE OPEN                                       11
 S_TRAP_8     MP2IVOP                                          SVIV11
   T4:348        I:025                                           O:045
|--+--] [--+-----] [---------------------------------------------( )----|
|  |   TT  |      13                                              06
|  |[64]   |
|  |OPEN   |
|  |CRYO ROUGH
|  |VALVE 11
|  |CR11   |
|  |  O:057|
|  +--] [--+
|       12
|  [174]
```

Rung #066

```
|COMPRESSOR
|8 REGEN-
|ERATION                                                        SIEVE TRAP
|PROGRAM                                                        HEATER 11
|CYRGN8      S_TRAP_8                                           SVHTR11
|   B3       +-LEQ------------------------+                       O:043
|---] [------+LESS THAN OR EQUAL (A<=B)   +-----------------------( )----|
|   328      |SOURCE A:       T4:348.ACC|                          02
|   ]        |                         0|
|            |SOURCE B:             3600|
|            |                      3600|
|            +--------------------------+
|            T4:348.ACC - [64]
```

Rung #067

```
|COMPRESSOR
|2 REGEN-                                                       SCREEN
|ERATION                                                        REGENERATION
|PROGRAM                                                        CRYO 2
|CYRGN2                                                         SCRRGN2
|   B3                                                             B3
|---] [-----------------------------------------------------------( )----|
|   322                                                            802
|[34]
```

Rung #068

```
|COMPRESSOR
|3 REGEN-                                                       SCREEN
|ERATION                                                        REGENERATION
|PROGRAM                                                        CRYO 3
|CYRGN3                                                         SCRRGN3
|   B3                                                             B3
|---] [-----------------------------------------------------------( )----|
|   323                                                            803
|[38]
```

Rung #069

```
|COMPRESSOR
|4 REGEN-                                                       SCREEN
|ERATION                                                        REGENERATION
|PROGRAM                                                        CRYO 4
|CYRGN4                                                         SCRRGN4
|   B3                                                             B3
|---] [-----------------------------------------------------------( )----|
|   324                                                            804
|[42]
```

```
Rung #070
|COMPRESSOR                                                        |
|5 REGEN-                                               SCREEN     |
|ERATION                                                REGENERATION|
|PROGRAM                                                CRYO 5     |
|CYRGN5                                                 SCRRGN5    |
|    B3                                                    B3      |
|----] [------------------------------------------------------( )---|
|   325                                                   805      |
|[46]
Rung #071
|COMPRESSOR                                                        |
|6 REGEN-                                               SCREEN     |
|ERATION                                                REGENERATION|
|PROGRAM                                                CRYO 6     |
|CYRGN6                                                 SCRRGN6    |
|    B3                                                    B3      |
|----] [------------------------------------------------------( )---|
|   326                                                   806      |
|[53]
Rung #072
|COMPRESSOR                                                        |
|7 REGEN-                                               SCREEN     |
|ERATION                                                REGENERATION|
|PROGRAM                                                CRYO 7     |
|CYRGN7                                                 SCRRGN7    |
     B3                                                    B3      |
   --] [------------------------------------------------------( )---|
|   327                                                   807      |
|[57]
Rung #073
|COMPRESSOR                                                        |
|8 REGEN-                                               SCREEN     |
|ERATION                                                REGENERATION|
|PROGRAM                                                CRYO 8     |
|CYRGN8                                                 SCRRGN8    |
|    B3                                                    B3      |
|----] [------------------------------------------------------( )---|
|   328                                                   808      |
|[63]
Rung #074
|COMPRESSOR                                                        |
|2 REGEN-                                                          |
|ERATION     CRYO REGEN                                            |
|PROGRAM     2 PULSE                                     PURGE 2   |
|CYRGN2      CR2PT                                       P2        |
|    B3        T4:62                                        B3      |
|----] [--------] [--------------------------------------------(L)--|
|   322          TT                                        632     |
 [34]        [35]
B3/632 - -] [- - File #3 CRYO_REGEN -   88,110,128
                 File #6 TECH_RUNGS -   15
       -(L)- - File #3 CRYO_REGEN -   74
       -(U)- - File #3 CRYO_REGEN -   135
```

Rung #075

```
|COMPRESSOR                                                                    |
|3 REGEN-                                                                      |
|ERATION     CRYO REGEN                                                        |
|PROGRAM     3 PULSE                                                PURGE 3    |
|CYRGN3      CR3PT                                                  P3         |
|     B3         T4:63                                                B3       |
|----] [---------] [---------------------------------------------------(L)-----|
|    323          TT                                                  633      |
|[38]        [39]                                                              |
B3/633 - ] [ - File #3 CRYO_REGEN -  89,111,129
               File #6 TECH_RUNGS -  15
       -(L)- - File #3 CRYO_REGEN -  75
       -(U)- - File #3 CRYO_REGEN -  136
```

Rung #076

```
|COMPRESSOR                                                                    |
|4 REGEN-                                                                      |
|ERATION     CRYO REGEN                                                        |
|PROGRAM     4 PULSE                                                PURGE 4    |
|CYRGN4      CR4PT                                                  P4         |
|     B3         T4:64                                                B3       |
|----] [---------] [---------------------------------------------------(L)-----|
|    324          TT                                                  634      |
|[42]        [43]                                                              |
B3/634 - ] [ - File #3 CRYO_REGEN -  90,112,130
               File #6 TECH_RUNGS -  15
       -(L)- - File #3 CRYO_REGEN -  76
       -(U)- - File #3 CRYO_REGEN -  137
```

..ung #077

```
|COMPRESSOR                                                                    |
|5 REGEN-                                                                      |
|ERATION     CRYO REGEN                                                        |
|PROGRAM     5 PULSE                                                PURGE 5    |
|CYRGN5      CR5PT                                                  P5         |
|     B3         T4:65                                                B3       |
|----] [---------] [---------------------------------------------------(L)-----|
|    325          TT                                                  635      |
|[46]        [47]                                                              |
B3/635 - ] [ - File #3 CRYO_REGEN -  91,92,93,113,131
               File #6 TECH_RUNGS -  15
       -(L)- - File #3 CRYO_REGEN -  77
       -(U)- - File #3 CRYO_REGEN -  138
```

Rung #078

```
|COMPRESSOR                                                                    |
|6 REGEN-                                                                      |
|ERATION     CRYO REGE]                                                        |
|PROGRAM     6 PULSE                                                PURGE 6    |
|CYRGN6      CR6PT                                                  P6         |
|     B3         T4:66                                                B3       |
 ----] [---------] [---------------------------------------------------(L)-----|
|    326          TT                                                  636      |
|[53]        [54]                                                              |
B3/636 - ] [ - File #3 CRYO_REGEN -  94,114,132
               File #6 TECH_RUNGS -  15
       -(L)- - File #3 CRYO_REGEN -  78
       -(U)- - File #3 CRYO_REGEN -  139
```

```
Rung #079
|COMPRESSOR
|7 REGEN-
|ERATION     CRYO REGEN                                                              PURGE 7
|PROGRAM     7 PULSE                                                                 P7
|CYRGN7      CR7PT                                                                      B3
|    B3        T4:67
|----] [--------] [------------------------------------------------------------------(L)---|
|   327         TT                                                                     637
|[57]        [58]
B3/637 - -] [- - File #3 CRYO_REGEN -  95,96,97,115,133
                 File #6 TECH_RUNGS -  15
        -(L)- - File #3 CRYO_REGEN -  79
        -(U)- - File #3 CRYO_REGEN -  140
Rung #080
|COMPRESSOR
|8 REGEN-
|ERATION     CRYO REGEN                                                              PURGE 8
|PROGRAM     8 PULSE                                                                 P8
|CYRGN8      CR8PT                                                                      B3
|    B3        T4:68
|----] [--------] [------------------------------------------------------------------(L)---|
|   328         TT                                                                     638
|[63]        [64]
B3/638 - -] [- - File #3 CRYO_REGEN -  98,116,134
                 File #6 TECH_RUNGS -  15
        -(L)- - File #3 CRYO_REGEN -  80
        -(U)- - File #3 CRYO_REGEN -  141
Rung #081
|                                                                              ENABLE
|                                                                              CRYO
|                                                                              COMPRESSOR
|  CRYO REGEN                                                                  2
|  2 PULSE                                                                     CY2
|  CR2PT                                                                         O:010
|    T4:62
|-+----] [----+--------------------------------------------------------------+----(U)----+-|
| |      TT   |                                                              |     05     | |
| |[35]       |                                                              |            | |
| |           | O:010/05 - -] [- - File #2 MAIN_PRGRM - 436, 440             |            | |
| |           |                    File #3 CRYO_REGEN - 260                  |MANUAL CRYO | |
| |           |                    File #6 TECH_RUNGS - 19                   |COMPRESSOR 2| |
| |           |             -(L)- - File #2 MAIN_PRGRM - 27                  |RUN         | |
| |           | N7:34/6 - -(L)- - File #2 MAIN_PRGRM - 27                    |MCYC2RUN    | |
| |MAIN WATER ON | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |   N7:34    | |
| |MAIN_H20   | N7:29/6 - -(U)- - File #2 MAIN_PRGRM - 27                    +----(U)-----+ |
| |   I:002   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                  |     6      | |
| +-----]/[---+                                                              |            | |
| |     07    |                                                              |MANUAL CRYO | |
| |MANUAL     |                                                              |COMPRESSOR 2| |
| |CONTROL    |                                                              |STOP        | |
| |STOP CRYO  |                                                              |MCYC2STOP   | |
| |COMPRESSOR |                                                              |   N7:29    | |
| |2          |                                                              +----(L)-----+ |
| |M-CY2-0    |                                                                    6          |
| |   N7:8    |                                                                               |
| +----] [----+                                                                               |
|       6                                                                                     |
|  [2:3]                                                                                      |
```

Rung #082

```
CRYO REGEN                                                   ENABLE
3 PULSE                                                      CRYO
CR3PT                                                        COMPRESSOR
T4:63                                                        3
                                                             CY3
                                                             0:030
--| |--------------------------------------------------------(U)--
   TT                                                        04
[39]
   0:030/04 - -| |- - File #2 MAIN_PRGRM - 440
                      File #3 CRYO_REGEN - 260               MANUAL CRYO
                      File #6 TECH_RUNGS - 19                COMPRESSOR 3
              -(L)- - File #2 MAIN_PRGRM - 28                RUN
   N7:34/7 - -(L)- - File #2 MAIN_PRGRM - 28                 MCYC3RUN
MAIN WATER ON  _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   N7:34
MAIN_H20       N7:29/7 - -(U)- - File #2 MAIN_PRGRM - 28     --(U)--
1:002          _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   7
--|/|--
07                                                           MANUAL CRYO
MANUAL                                                       COMPRESSOR 3
CONTROL                                                      STOP
STOP CRYO                                                    MCYC3STOP
COMPRESSOR                                                   N7:29
3                                                            --(L)--
N-CY3-0                                                      7
N7:8
--| |--
7
[2:3]
```

Rung #083

```
CRYO REGEN                                                   ENABLE
4 PULSE                                                      CRYO
CR4PT                                                        COMPRESSOR
T4:64                                                        4
                                                             CY4
                                                             0:030
--| |--------------------------------------------------------(U)--
   TT                                                        05
[43]
   0:030/05 - -| |- - File #2 MAIN_PRGRM - 440
                      File #3 CRYO_REGEN - 260               MANUAL CRYO
                      File #6 TECH_RUNGS - 19                COMPRESSOR 4
              -(L)- - File #2 MAIN_PRGRM - 29                RUN
   N7:34/8 - -(L)- - File #2 MAIN_PRGRM - 29                 MCYC4RUN
MAIN WATER ON  _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   N7:34
MAIN_H20       N7:29/8 - -(U)- - File #2 MAIN_PRGRM - 29     --(U)--
1:002          _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   8
--|/|--
07                                                           MANUAL CRYO
MANUAL                                                       COMPRESSOR 4
CONTROL                                                      STOP
STOP CRYO                                                    MCYC4STOP
COMPRESSOR                                                   N7:29
4                                                            --(L)--
N-CY4-0                                                      8
N7:8
--| |--
8
[2:3]
```

Rung #084

CRYO REGEN
5 PULSE
CR5PT
T4:65
TT
[47]

ENABLE
CRYO
COMPRESSOR
5
CY5
O:044
(U)
04

O:044/04 -] [- File #2 MAIN_PRGRM - 440, 444
File #3 CRYO_REGEN - 260
File #6 TECH_RUNGS - 19
(L) - File #2 MAIN_PRGRM - 30
N7:34/9 - (L) - File #2 MAIN_PRGRM - 30
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/9 - (U) - File #2 MAIN_PRGRM - 30
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

MAIN WATER ON
MAIN_H20
I:002
]/[
07

MANUAL
CONTROL
STOP CRYO
COMPRESSOR
5
M-CY5-O
N7:8
] [
9
[2:3]

MANUAL CRYO
COMPRESSOR 5
RUN
MCYC5RUN
N7:34
(U)
9

MANUAL CRYO
COMPRESSOR 5
STOP
MCYC5STOP
N7:29
(L)
9

Rung #085

CRYO REGEI
6 PULSE
CR6PT
T4:66
TT
[54]

ENABLE
CRYO
COMPRESSOR
6
CY6
O:044
(U)
05

O:044/05 -] [- File #2 MAIN_PRGRM - 444
File #3 CRYO_REGEN - 260
File #6 TECH_RUNGS - 19
(L) - File #2 MAIN_PRGRM - 31
N7:34/10 - (L) - File #2 MAIN_PRGRM - 31
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/10 - (U) - File #2 MAIN_PRGRM - 31
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

MAIN WATER ON
MAIN_H20
I:002
]/[
07

MANUAL
CONTROL
STOP CRYO
COMPRESSOR
6
M-CY6-O
N7:8
] [
10
[2:3]

MANUAL CRYO
COMPRESSOR 6
RUN
MCYC6RUN
N7:34
(U)
10

MANUAL CRYO
COMPRESSOR 6
STOP
MCYC6STOP
N7:29
(L)
10

```
Rung #086
|                                                                              ENABLE          |
|                                                                              CRYO            |
| CRYO REGEN                                                                   COMPRESSOR      |
| 7 PULSE                                                                      7               |
| CR7PT                                                                        CY7             |
|    T4:67                                                                       O:060         |
|-+----] [----+-------------------------------------------------------------+----(U)------+--|
| | |   TT    |                                                             |     04      |  |
| | [58]      |                                                             |             |  |
| |           | O:060/04 - -] [- - File #2 MAIN_PRGRM - 449, 453            |             |  |
| |           |                    File #3 CRYO_REGEN - 260                 |MANUAL CRYO  |  |
| |           |                    File #6 TECH_RUNGS - 19                  |COMPRESSOR 7 |  |
| |           |            -(L)- - File #2 MAIN_PRGRM - 32                  |RUN          |  |
| |           | N7:34/11 - -(L)- - File #2 MAIN_PRGRM - 32                  |MCYC7RUN     |  |
| |MAIN WATER ON | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2              |   N7:34     |  |
| |MAIN_H2O   | N7:29/11 - -(U)- - File #2 MAIN_PRGRM - 32                  +----(U)------+  |
| |    I:002  | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                 |     11      |  |
| +----]/[----+                                                             |             |  |
| |     07    |                                                             |             |  |
| |MANUAL     |                                                             |MANUAL CRYO  |  |
| |CONTROL    |                                                             |COMPRESSOR 7 |  |
| |STOP CRYO  |                                                             |STOP         |  |
| |COMPRESSOR |                                                             |MCYC7STOP    |  |
| |7          |                                                             |   N7:29     |  |
| |M-CY7-0    |                                                             +----(L)------+  |
| |   N7:8    |                                                                   11         |
|  ----] [----+                                                                              |
|      11                                                                                    |
| [2:3]                                                                                      |
Rung #087
|                                                                              ENABLE          |
|                                                                              CRYO            |
| CRYO REGEN                                                                   COMPRESSOR      |
| 8 PULSE                                                                      8               |
| CR8PT                                                                        CY8             |
|    T4:68                                                                       O:060         |
|-+----] [----+-------------------------------------------------------------+----(U)------+--|
| | |   TT    |                                                             |     05      |  |
| | [64]      |                                                             |             |  |
| |           | O:060/05 - -] [- - File #2 MAIN_PRGRM - 449                 |             |  |
| |           |                    File #3 CRYO_REGEN - 260                 |MANUAL CRYO  |  |
| |           |                    File #6 TECH_RUNGS - 19                  |COMPRESSOR 8 |  |
| |           |            -(L)- - File #2 MAIN_PRGRM - 33                  |RUN          |  |
| |           | N7:34/12 - -(L)- - File #2 MAIN_PRGRM - 33                  |MCYC8RUN     |  |
| |MAIN WATER ON | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2              |   N7:34     |  |
| |MAIN_H2O   | N7:29/12 - -(U)- - File #2 MAIN_PRGRM - 33                  +----(U)------+  |
| |    I:002  | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                 |     12      |  |
| +----]/[----+                                                             |             |  |
| |     07    |                                                             |             |  |
| |MANUAL     |                                                             |MANUAL CRYO  |  |
| |CONTROL    |                                                             |COMPRESSOR 8 |  |
| |STOP CRYO  |                                                             |STOP         |  |
| |COMPRESSOR |                                                             |MCYC8STOP    |  |
| |8          |                                                             |   N7:29     |  |
| |M-CY8-0    |                                                             +----(L)------+  |
| |   N7:8    |                                                                   12         |
| +----] [----+                                                                              |
|      12                                                                                    |
| [2:3]                                                                                      |
```

502

```
Rung #088
|                         OPEN                                                OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                              VALVE 2   |
|PURGE 2  2 PULSE      VALVE 2                                               NIF2      |
|P2       CR2PT        CR2                                                      0:007  |
|  B3        T4:62       0:007                                                         |
|--] [--------] [--------]/[--------------------------------------------------(L)------|
|  632         TT          12                                                  07      |
|[74]      [35]        [164]
0:007/07 - ] [ - File #3 CRYO_REGEN -  99
                 File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN - 88
          -(U)- - File #3 CRYO_REGEN - 117
Rung #089
|                         OPEN                                                OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                              VALVE 3   |
|PURGE 3  3 PULSE      VALVE 3                                               NIF3      |
|P3       CR3PT        CR3                                                      0:007  |
|  B3        T4:63       0:007                                                         |
|--] [--------] [--------]/[--------------------------------------------------(L)------|
|  633         TT          13                                                  10      |
|[75]      [39]        [165]
0:007/10 - ] [ - File #3 CRYO_REGEN -  100
                 File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN - 89
          -(U)- - File #3 CRYO_REGEN - 118
Rung #090
                          OPEN                                                OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                              VALVE 5   |
|PURGE 4  4 PULSE      VALVE 5                                               NIF5      |
|P4       CR4PT        CR5                                                      0:027  |
|  B3        T4:64       0:027                                                         |
|--] [--------] [--------]/[--------------------------------------------------(L)------|
|  634         TT          12                                                  07      |
|[76]      [43]        [166]
0:027/07 - ] [ - File #3 CRYO_REGEN -  102
                 File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN - 90
          -(U)- - File #3 CRYO_REGEN - 119
Rung #091
|                         OPEN                                                OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                              VALVE 4   |
|PURGE 5  5 PULSE      VALVE 4                                               NIF4      |
|P5       CR5PT        CR4                                                      0:027  |
|  B3        T4:65       0:027                                                         |
|--] [--------] [--------]/[--------------------------------------------------(L)------|
|  635         TT          11                                                  06      |
|[77]      [47]        [167]
0:027/06 - ] [ - File #3 CRYO_REGEN -  101
                 File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN - 91
          -(U)- - File #3 CRYO_REGEN - 120
Rung #092
|                         OPEN                                                OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                              VALVE 6   |
|PURGE 5  5 PULSE      VALVE 6                                               NIF6      |
|P5       CR5PT        CR6                                                      0:027  |
|  B3        T4:65       0:027                                                         |
|--] [--------] [--------]/[--------------------------------------------------(L)------|
|  635         TT          13                                                  10      |
|[77]      [47]        [168]
0:027/10 - ] [ - File #3 CRYO_REGEN -  103
```

```
                    File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  92
          -(U)- - File #3 CRYO_REGEN -  121
Rung #093
|                      OPEN                                                   |
|         CRYO REGEN  CRYO ROUGH                                  OPEN PURGE  |
|PURGE 5  5 PULSE     VALVE 7                                     VALVE 7     |
|P5       CR5PT       CR7                                         NIF7        |
|  B3      T4:65       O:043                                        O:043     |
|--] [------] [--------]/[--------------------------------------------(L)-----|
|  635      TT          11                                            06      |
|[77]     [47]       [169]                                                    |
O:043/06 - ] [ - - File #3 CRYO_REGEN -  104
                    File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  93
          -(U)- - File #3 CRYO_REGEN -  122
Rung #094
|                      OPEN                                                   |
|         CRYO REGEI  CRYO ROUGH                                  OPEN PURGE  |
|PURGE 6  6 PULSE     VALVE 8                                     VALVE 8     |
|P6       CR6PT       CR8                                         NIF8        |
|  B3      T4:66       O:043                                        O:043     |
|--] [------] [--------]/[--------------------------------------------(L)-----|
|  636      TT          12                                            07      |
|[78]     [54]       [170]                                                    |
O:043/07 - ] [ - - File #3 CRYO_REGEN -  106
                    File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  94
          -(U)- - File #3 CRYO_REGEN -  123
Rung #095
|                      OPEN                                                   |
|         CRYO REGEN  CRYO ROUGH                                  OPEN PURGE  |
|PURGE 7  7 PULSE     VALVE 9                                     VALVE 9     |
|P7       CR7PT       CR9                                         NIF9        |
|  B3      T4:67       O:043                                        O:043     |
|--] [------] [--------]/[--------------------------------------------(L)-----|
|  637      TT          13                                            10      |
|[79]     [58]       [171]                                                    |
O:043/10 - ] [ - - File #3 CRYO_REGEN -  105
                    File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  95
          -(U)- - File #3 CRYO_REGEN -  124
Rung #096
|                      OPEN                                                   |
|         CRYO REGEN  CRYO ROUGH                                  OPEN PURGE  |
|PURGE 7  7 PULSE     VALVE 10                                    VALVE 10    |
|P7       CR7PT       CR10                                        NIF10       |
|  B3      T4:67       O:057                                        O:057     |
|--] [------] [--------]/[--------------------------------------------(L)-----|
|  637      TT          11                                            06      |
|[79]     [58]       [172]                                                    |
O:057/06 - ] [ - - File #3 CRYO_REGEN -  107
                    File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  96
          -(U)- - File #3 CRYO_REGEN -  125
```

504

Rung #097

```
|                              OPEN                                   OPEN PURGE |
|          CRYO REGEN          CRYO ROUGH                             VALVE 12   |
|PURGE 7   7 PULSE             VALVE 12                               NIF12      |
|P7        CR7PT               CR12                                    0:057     |
|   B3        T4:67             0:057                                            |
|---] [--------] [---------------]/[-------------------------------------(L)-----|
|   637         TT               13                                      10      |
|[79]       [58]              [173]                                              |
0:057/10 - ] [ - File #3 CRYO_REGEN - 108
                 File #6 TECH_RUNGS - 16
         -(L)- - File #3 CRYO_REGEN - 97
         -(U)- - File #3 CRYO_REGEN - 126
```

Rung #098

```
|                              OPEN                                   OPEN PURGE |
|          CRYO REGEN          CRYO ROUGH                             VALVE 11   |
|PURGE 8   8 PULSE             VALVE 11                               NIF11      |
|P8        CR8PT               CR11                                    0:057     |
|   B3        T4:68             0:057                                            |
|---] [--------] [---------------]/[-------------------------------------(L)-----|
|   638         TT               12                                      07      |
|[80]       [64]              [174]                                              |
0:057/07 - ] [ - File #3 CRYO_REGEN - 109
                 File #6 TECH_RUNGS - 16
         -(L)- - File #3 CRYO_REGEN - 98
         -(U)- - File #3 CRYO_REGEN - 127
```

Rung #099

```
                                                                      ENABLE     |
|OPEN PURGE                                                           PURGE      |
|VALVE 2                                                              HEATER 2   |
|NIF2                                                                 NIH2       |
|   0:007                                                              0:007     |
|---] [------------------------------------------------------------------( )-----|
|     07                                                                 04      |
|[88]
0:007/04 - ] [ - File #3 CRYO_REGEN - 110
         -( )- - File #3 CRYO_REGEN - 99
```

Rung #100

```
|                                                                     ENABLE     |
|OPEN PURGE                                                           PURGE      |
|VALVE 3                                                              HEATER 3   |
|NIF3                                                                 NIH3       |
|   0:007                                                              0:007     |
|---] [------------------------------------------------------------------( )-----|
|     10                                                                 05      |
|[89]
0:007/05 - ] [ - File #3 CRYO_REGEN - 111
         -( )- - File #3 CRYO_REGEN - 100
```

Rung #101

```
                                                                      ENABLE     |
|OPEN PURGE                                                           PURGE      |
|VALVE 4                                                              HEATER 4   |
|NIF4                                                                 NIH4       |
|   0:027                                                              0:027     |
|---] [------------------------------------------------------------------( )-----|
|     06                                                                 03      |
|[91]
0:027/03 - ] [ - File #3 CRYO_REGEN - 113
         -( )- - File #3 CRYO_REGEN - 101
```

505

Rung #102

```
|                                                                 ENABLE   |
|OPEN PURGE                                                       PURGE    |
|VALVE 5                                                          HEATER 5 |
|NIF5                                                             NIH5     |
|   O:027                                                          O:027   |
|----] [---------------------------------------------------------( )------|
|     07                                                             04    |
|[90]                                                                      |
O:027/04 - -] [- - File #3 CRYO_REGEN -  112
          -( )- - File #3 CRYO_REGEN -  102
```

Rung #103

```
|                                                                 ENABLE   |
|OPEN PURGE                                                       PURGE    |
|VALVE 6                                                          HEATER 6 |
|NIF6                                                             NIH6     |
|   O:027                                                          O:027   |
|----] [---------------------------------------------------------( )------|
|     10                                                             05    |
|[92]                                                                      |
O:027/05 - -] [- - File #3 CRYO_REGEN -  113
          -( )- - File #3 CRYO_REGEN -  103
```

Rung #104

```
|                                                                 ENABLE   |
|OPEN PURGE                                                       PURGE    |
|VALVE 7                                                          HEATER 7 |
|NIF7                                                             NIH7     |
|   O:043                                                          O:043   |
|----] [---------------------------------------------------------( )------|
|     06                                                             03    |
|[93]                                                                      |
O:043/03 - -] [- - File #3 CRYO_REGEN -  113
          -( )- - File #3 CRYO_REGEN -  104
```

Rung #105

```
|                                                                 ENABLE   |
|OPEN PURGE                                                       PURGE    |
|VALVE 9                                                          HEATER 9 |
|NIF9                                                             NIH9     |
|   O:043                                                          O:043   |
|----] [---------------------------------------------------------( )------|
|     10                                                             05    |
|[95]                                                                      |
O:043/05 - -] [- - File #3 CRYO_REGEN -  115
          -( )- - File #3 CRYO_REGEN -  105
```

Rung #106

```
|                                                                 ENABLE   |
|OPEN PURGE                                                       PURGE    |
|VALVE 8                                                          HEATER 8 |
|NIF8                                                             NIH8     |
|   O:043                                                          O:043   |
|----] [---------------------------------------------------------( )------|
|     07                                                             04    |
|[94]                                                                      |
O:043/04 - -] [- - File #3 CRYO_REGEN -  114
          -( )- - File #3 CRYO_REGEN -  106
```

```
Rung #107                                                              ENABLE    |
|                                                                      PURGE     |
|OPEN PURGE                                                            HEATER 10 |
|VALVE 10                                                              NIH10     |
|NIF10                                                                   O:057   |
|   O:057                                                              --( )---- |
|---] [--------------------------------------------------------------------------|
|    06                                                                   03     |
|[96]                                                                            |
O:057/03 - -] [- - File #3 CRYO_REGEN - 115
           -( )- - File #3 CRYO_REGEN - 107
Rung #108                                                              ENABLE    |
|                                                                      PURGE     |
|OPEN PURGE                                                            HEATER 12 |
|VALVE 12                                                              NIH12     |
|NIF12                                                                   O:057   |
|   O:057                                                              --( )---- |
|---] [--------------------------------------------------------------------------|
|    10                                                                   05     |
|[97]                                                                            |
O:057/05 - -] [- - File #3 CRYO_REGEN - 115
           -( )- - File #3 CRYO_REGEN - 108
Rung #109                                                              ENABLE    |
|                                                                      PURGE     |
|OPEN PURGE                                                            HEATER 11 |
|VALVE 11                                                              NIH11     |
|NIF11                                                                   O:057   |
|   O:057                                                              --( )---- |
|---] [--------------------------------------------------------------------------|
|    07                                                                   04     |
|[98]                                                                            |
O:057/04 - -] [- - File #3 CRYO_REGEN - 116
           -( )- - File #3 CRYO_REGEN - 109
Rung #110
|          ENABLE    CRYO 2      PURGE                   PURGE TIME              |
|          PURGE     TEMPERATUR  TIMER                   MONITOR                 |
|PURGE 2   HEATER 2  =>290K      DEFEAT                  COMPRESSOR 2            |
|P2        NIH2      CY2TMP290   PG_DEFEAT               PGC2                    |
|  B3       O:007      B3          B3                    +--TON-------------+    |
|--] [-------] [-------] [--------] [--------------------|TIMER ON DELAY    |-(EN)-|
|  632        04       514         288                   |TIMER:      T4:22 |    |
|[135]      [99]                                         |BASE (SEC):   1.0 |-(DN)|
|                                                        |PRESET:     7200  |    |
|                                                        |ACCUM:         0  |    |
|                                                        +------------------+    |
T4:22.ACC - GEQ - File #3 CRYO_REGEN - 252
T4:22.DN - -] [- - File #3 CRYO_REGEN - 117,128,262
T4:22.TT - -] [- - File #6 TECH_RUNGS - 15
Rung #111
           ENABLE    CRYO 3      PURGE                   PURGE TIME              |
|          PURGE     TEMPERATUR  TIMER                   MONITOR                 |
|PURGE 3   HEATER 3  =>290K      DEFEAT                  COMPRESSOR 3            |
|P3        NIH3      CY3TMP290   PG_DEFEAT               PGC3                    |
|  B3       O:007      B3          B3                    +--TON-------------+    |
|--] [-------] [-------] [--------] [--------------------|TIMER ON DELAY    |-(EN)-|
|  633        05       515         288                   |TIMER:      T4:23 |    |
|[136]      [100]                                        |BASE (SEC):   1.0 |-(DN)|
|                                                        |PRESET:     7200  |    |
|                                                        |ACCUM:         0  |    |
|                                                        +------------------+    |
T4:23.ACC - GEQ - File #3 CRYO_REGEN - 253
T4:23.DN - -] [- - File #3 CRYO_REGEN - 118,129,262
```

```
T4:23.TT - -| |- - File #6 TECH_RUNGS -  15
Rung #112
|        ENABLE    CRYO 5     PURGE                                        PURGE TIME
|        PURGE     TEMPERATUR TIMER                                        MONITOR
|PURGE 4 HEATER 5  =>290K     DEFEAT                                       COMPRESSOR 4
|P4      NIH5      CY5TMP290  PG_DEFEAT                                    PGC4
|  B3     O:027      B3         B3                                        +-TON-----------------+
|--| |-----| |-------| |--------| |---------------------------------------|TIMER ON DELAY       |-(EN)-
|  634      04       517        288                                       |TIMER:          T4:24|
|[137]    [102]                                                           |BASE (SEC):       1.0|-(DN)
|                                                                         |PRESET:          7200|
|                                                                         |ACCUM:              0|
|                                                                         +---------------------+
T4:24.ACC - GEQ - File #3 CRYO_REGEN -  254
T4:24.DN - -| |- - File #3 CRYO_REGEN -  119,130,262
T4:24.TT - -| |- - File #6 TECH_RUNGS -  15
Rung #113
|         ENABLE     CRYO 4     CRYO 6     CRYO 7     PURGE                PURGE TIME
|         PURGE      TEMPERATUR TEMPERATUR TEMPERATUR TIMER                MONITOR
|PURGE 5  HEATER 4   =>290K     =>290K     =>290K     DEFEAT               COMPRESSOR 5
|P5       NIH4       CY4TMP290  CY6TMP290  CY7TMP290  PG_DEFEAT            PGC5
|  B3      O:027       B3         B3         B3         B3                +-TON-----------------+
|--| |----+--| |--+----| |--------| |--------| |--------| |---------------|TIMER ON DELAY       |-(EN)-
|  635    |   03  |    516        518        519        288               |TIMER:          T4:25|
|[138]    |[101]  |                                                       |BASE (SEC):       1.0|-(DN)
|         |       | T4:25.ACC - GEQ - File #3 CRYO_REGEN - 255            |PRESET:          7200|
|         |       | T4:25.DN - -| |- - File #3 CRYO_REGEN - 120, 121, 122, 131, 262  |ACCUM:  0|
|         |       | T4:25.TT - -| |- - File #6 TECH_RUNGS - 15            +---------------------+
|         |ENABLE |
|         |PURGE  |
|         |HEATER 6
|         |NIH6   |
|         | O:027 |
|         +--| |--+
|         |   05  |
|         |[103]  |
|         |ENABLE |
|         |PURGE  |
|         |HEATER 7
|         |NIH7   |
|         | O:043 |
|         +--| |--+
|             03
|           [104]
Rung #114
|        ENABLE    CRYO 8     PURGE                                        PURGE TIME
|        PURGE     TEMPERATUR TIMER                                        MONITOR
|PURGE 6 HEATER 8  =>290K     DEFEAT                                       COMPRESSOR 6
|P6      NIH8      CY8TMP290  PG_DEFEAT                                    PGC6
|  B3     O:043      B3         B3                                        +-TON-----------------+
|--| |-----| |-------| |--------| |---------------------------------------|TIMER ON DELAY       |-(EN)-
|  636      04       520        288                                       |TIMER:          T4:26|
|[139]    [106]                                                           |BASE (SEC):       1.0|-(DN)
|                                                                         |PRESET:          7200|
|                                                                         |ACCUM:              0|
|                                                                         +---------------------+
T4:26.ACC - GEQ - File #3 CRYO_REGEN -  256
T4:26.DN - -| |- - File #3 CRYO_REGEN -  123,132,262
T4:26.TT - -| |- - File #6 TECH_RUNGS -  15
```

```
Rung #115
|         ENABLE        CRYO 9       CYRO 10      CRYO 12      PURGE                                         PURGE TIME        |
|         PURGE         TEMPERATUR   TEMPERATUR   TEMPERATUR   TIMER                                         MONITOR           |
|PURGE 7  HEATER 9      =>290K       =>290K       =>290K       DEFEAT                                        COMPRESSOR 7      |
|P7       NIH9          CY9TMP290    CY10TMP290   CY12TMP290   PG_DEFEAT                                     PGC7              |
|  B3       O:043           B3           B3           B3          B3                                        ┌─TON──────────────┐  |
|─┤ ├──────┤ ├──────────────┤ ├──────────┤ ├──────────┤ ├─────────┤ ├──────────────────────────────────────────┤TIMER ON DELAY    ├─(EN)─|
|  637    |  05     |       521          522          524         288                                       |TIMER:       T4:27|     |
|[140]    |[105]    |                                                                                       |BASE (SEC):   1.0├─(DN) |
|         |         | T4:27.ACC - GEQ - File #3 CRYO_REGEN - 257                                             |PRESET:      7200|     |
|         |         | T4:27.DN - ┤ ├ - File #3 CRYO_REGEN - 124, 125, 126, 133, 262                          |ACCUM:          0|     |
|         |         | T4:27.TT - ┤ ├ - File #6 TECH_RUNGS - 15                                               └──────────────────┘     |
|         |         |                                                                                                               |
|         |ENABLE   |                                                                                                               |
|         |PURGE    |                                                                                                               |
|         |HEATER 10|                                                                                                               |
|         |NIH10    |                                                                                                               |
|         |  O:057  |                                                                                                               |
|         |───┤ ├───|                                                                                                               |
|         |    03   |                                                                                                               |
|         |[107]    |                                                                                                               |
|         |ENABLE   |                                                                                                               |
|         |PURGE    |                                                                                                               |
|         |HEATER 12|                                                                                                               |
|         |NIH12    |                                                                                                               |
|         |  O:057  |                                                                                                               |
|         └───┤ ├───┘                                                                                                               |
|             05                                                                                                                    |
            [108]
Rung #116
|        ENABLE      CRYO 11      PURGE                                                                  PURGE TIME               |
|        PURGE       TEMPERATUR   TIMER                                                                  MONITOR                  |
|PURGE 8 HEATER 11   =>290K       DEFEAT                                                                 COMPRESSOR 8             |
|P8      NIH11       CY11TMP290   PG_DEFEAT                                                              PGC8                     |
|  B3      O:057        B3           B3                                                                  ┌─TON──────────────┐     |
|─┤ ├─────┤ ├──────────┤ ├─────────┤ ├─────────────────────────────────────────────────────────────────────┤TIMER ON DELAY    ├─(EN)─|
|  638      04         523          288                                                                  |TIMER:       T4:28|     |
|[141]    [109]                                                                                          |BASE (SEC):   1.0├─(DN) |
|                                                                                                        |PRESET:      7200|     |
|                                                                                                        |ACCUM:          0|     |
|                                                                                                        └──────────────────┘     |
T4:28.ACC - GEQ - File #3 CRYO_REGEN - 258
T4:28.DN - ┤ ├ - File #3 CRYO_REGEN - 127,134,262
T4:28.TT - ┤ ├ - File #6 TECH_RUNGS - 15
```

509

```
Rung #117
            PURGE TIME
            MONITOR
 CRYO 2     CRYO 2                                         OPEN PURGE
 TEMPERATUR 120 MIN.    BLOWER 2                           VALVE 2
 =>290K     DONE        ENABLED                            NIF2
 CY2TMP290  PGC2        BL2                                  O:007
    B3        T4:22     O:027
 ---] [--------] [-------] [-----------------------------------(U)---
    514        DN        01                                     07
             [110]     [2:74]
                               O:007/07 - ] [ - File #3 CRYO_REGEN - 99
                                              File #6 TECH_RUNGS - 16
                                        -(L)- File #3 CRYO_REGEN - 88
 |COMPRESSOR
 |2 REGEN-
 |ERATION
 |PROGRAM
 |CYRGN2
 |   B3
 +---]/[--------------------+
    322
 [34]
```

```
Rung #118
            PURGE TIME
            MONITOR
 CRYO 3     CRYO 3                                         OPEN PURGE
 TEMPERATUR 120 MIN.    BLOWER 2                           VALVE 3
 =>290K     DONE        ENABLED                            NIF3
 CY3TMP290  PGC3        BL2                                  O:007
    B3        T4:23     O:027
 ---] [--------] [-------] [-----------------------------------(U)---
    515        DN        01                                     10
             [111]     [2:74]
                               O:007/10 - ] [ - File #3 CRYO_REGEN - 100
                                              File #6 TECH_RUNGS - 16
                                        -(L)- File #3 CRYO_REGEN - 89
 |COMPRESSOR
 |3 REGEN-
 |ERATION
 |PROGRAM
 |CYRGN3
 |   B3
 +---]/[--------------------+
    323
 [38]
```

510

```
Rung #119
|          PURGE TIME
|          MONITOR
| CRYO 5   CRYO 4                                                            |
| TEMPERATUR 120 MIN   BLOWER 2                                  OPEN PURGE  |
| =>290K   DONE       ENABLED                                    VALVE 5     |
| CY5TMP290 PGC4      BL2                                        NIF5        |
|    B3      T4:24     O:027                                        O:027    |
|-+--] [------] [-------] [---+----------------------------------------(U)---|
| |  517       DN        01   |                                        07    |
| |           [112]    [2:74] |                                              |
| |                           | O:027/07 - ] [ - File #3 CRYO_REGEN - 102    |
| |                           |              File #6 TECH_RUNGS - 16         |
| |COMPRESSOR                 |          -(L)- - File #3 CRYO_REGEN - 90     |
| |4 REGEN-                   |                                              |
| |ERATION                    |                                              |
| |PROGRAM                    |                                              |
| |CYRGN4                     |                                              |
| |   B3                      |                                              |
| +---]/[---------------------+                                              |
|     324                                                                    |
| [42]
Rung #120
|          PURGE TIME                                                        |
|          MONITOR                                                           |
| CRYO 4   CRYO 5                                                            |
| TEMPERATUR 120 MIN   BLOWER 2                                  OPEN PURGE  |
| =>290K   DONE       ENABLED                                    VALVE 4     |
| CY4TMP290 PGC5      BL2                                        NIF4        |
|    B3      T4:25     O:027                                        O:027    |
|-+--] [------] [-------] [---+----------------------------------------(U)---|
| |  516       DN        01   |                                        06    |
| |           [113]    [2:74] |                                              |
| |                           | O:027/06 - ] [ - File #3 CRYO_REGEN - 101    |
| |                           |              File #6 TECH_RUNGS - 16         |
| |COMPRESSOR                 |          -(L)- - File #3 CRYO_REGEN - 91     |
| |5 REGEN-                   |                                              |
| |ERATION                    |                                              |
| |PROGRAM                    |                                              |
| |CYRGN5                     |                                              |
| |   B3                      |                                              |
| +---]/[---------------------+                                              |
|     325                                                                    |
| [46]                                                                       |
```

```
Rung #121
|             PURGE TIME
|             MONITOR
| CRYO 6      CRYO 5                                                        OPEN PURGE |
| TEMPERATUR  120 MIN    BLOWER 2                                           VALVE 6    |
| =>290K      DONE       ENABLED                                            NIF6       |
| CY6TMP290   PGC5       BL2                                                  O:027    |
|    B3        T4:25      O:027                                                        |
|-+--] [--------] [--------] [--+------------------------------------------------(U)---|
| |  518         DN         01  |                                                10    |
| |             [113]      [2:74]                                                      |
| |                             | O:027/10 - ] [ - File #3 CRYO_REGEN - 103            |
| |                             |                  File #6 TECH_RUNGS - 16             |
| |COMPRESSOR                   |            -(L)- - File #3 CRYO_REGEN - 92           |
| |5 REGEN-                     |                                                      |
| |ERATION                      |                                                      |
| |PROGRAM                      |                                                      |
| |CYRGN5                       |                                                      |
| |    B3                       |                                                      |
| +---]/[-----------------------+                                                      |
|    325                                                                               |
| [46]                                                                                 |
Rung #122
|             PURGE TIME
|             MONITOR
| CRYO 7      CRYO 5                                                        OPEN PURGE |
| TEMPERATUR  120 MIN    BLOWER 2                                           VALVE 7    |
|  >290K      DONE       ENABLED                                            NIF7       |
| CY7TMP290   PGC5       BL2                                                  O:043    |
|    B3        T4:25      O:027                                                        |
|-+--] [--------] [--------] [--+------------------------------------------------(U)---|
| |  519         DN         01  |                                                06    |
| |             [113]      [2:74]                                                      |
| |                             | O:043/06 - ] [ - File #3 CRYO_REGEN - 104            |
| |                             |                  File #6 TECH_RUNGS - 16             |
| |COMPRESSOR                   |            -(L)- - File #3 CRYO_REGEN - 93           |
| |5 REGEN-                     |                                                      |
| |ERATION                      |                                                      |
| |PROGRAM                      |                                                      |
| |CYRGN5                       |                                                      |
| |    B3                       |                                                      |
| +---]/[-----------------------+                                                      |
|    325                                                                               |
| [46]                                                                                 |
```

```
Rung #123
|        PURGE TIME
|        MONITOR
| CRYO 8     CRYO 6                                                        OPEN PURGE
| TEMPERATUR 120 MIN    BLOWER 2                                           VALVE 8
| =>290K     DONE       ENABLED                                            NIF8
| CY8TMP290  PGC6       BL2                                                  O:043
|    B3       T4:26      O:027
|-+--] [--------] [--------] [---+-------------------------------------------(U)----|
| |  520        DN         01    |                                             07
| |            [114]      [2:74] |
| |                              | O:043/07 - ] [ - File #3 CRYO_REGEN - 106
| |                              |                File #6 TECH_RUNGS - 16
| |                              |          -(L)- - File #3 CRYO_REGEN - 94
| |COMPRESSOR                    |
| |6 REGEN-                      |
| |ERATION                       |
| |PROGRAM                       |
| |CYRGN6                        |
| |    B3                        |
| +---]/[------------------------+
|     326
|  [53]
Rung #124
|        PURGE TIME
|        MONITOR
| CRYO 9     CRYO 7                                                        OPEN PURGE
| TEMPERATUR 120 MIN    BLOWER 2                                           VALVE 9
|  >290K     DONE       ENABLED                                            NIF9
| CY9TMP290  PGC7       BL2                                                  O:043
|    B3       T4:27      O:027
|-+--] [--------] [--------] [---+-------------------------------------------(U)----|
| |  521        DN         01    |                                             10
| |            [115]      [2:74] |
| |                              | O:043/10 - ] [ - File #3 CRYO_REGEN - 105
| |                              |                File #6 TECH_RUNGS - 16
| |                              |          -(L)- - File #3 CRYO_REGEN - 95
| |COMPRESSOR                    |
| |7 REGEN-                      |
| |ERATION                       |
| |PROGRAM                       |
| |CYRGN7                        |
| |    B3                        |
| +---]/[------------------------+
|     327
|  [57]
```

```
Rung #125
|
|             PURGE TIME
|             MONITOR
| CYRO 10     CRYO 7                                                                OPEN PURGE
| TEMPERATUR  120 MIN     BLOWER 2                                                  VALVE 10
| =>290K      DONE        ENABLED                                                   NIF10
| CY10TMP290  PGC7        BL2                                                         0:057
|    B3          T4:27      0:027
|-+--] [--------] [--------] [---+---------------------------------------------------(U)---|
| |  522          DN          01 |                                                     06
| |              [115]      [2:74]|
| |                               | 0:057/06 - -] [- - File #3 CRYO_REGEN - 107
| |                               |                    File #6 TECH_RUNGS - 16
| |COMPRESSOR                     |              -(L)- - File #3 CRYO_REGEN - 96
| |7 REGEN-                       |
| |ERATION                        |
| |PROGRAM                        |
| |CYRGN7                         |
| |   B3                          |
| +--]/[--------------------------+
|    327
| [57]
Rung #126
|
|             PURGE TIME
|             MONITOR
| CRYO 12     CRYO 7                                                                OPEN PURGE
| TEMPERATUR  120 MIN     BLOWER 2                                                  VALVE 12
|  >290K      DONE        ENABLED                                                   NIF12
| CY12TMP290  PGC7        BL2                                                         0:057
|    B3          T4:27      0:027
|-+--] [--------] [--------] [---+---------------------------------------------------(U)---|
| |  524          DN          01 |                                                     10
| |              [115]      [2:74]|
| |                               | 0:057/10 - -] [- - File #3 CRYO_REGEN - 108
| |                               |                    File #6 TECH_RUNGS - 16
| |COMPRESSOR                     |              -(L)- - File #3 CRYO_REGEN - 97
| |7 REGEN-                       |
| |ERATION                        |
| |PROGRAM                        |
| |CYRGN7                         |
| |   B3                          |
| +--]/[--------------------------+
|    327
| [57]
```

514

```
Rung #127
|          PURGE TIME
|          MONITOR
| CRYO 11  CRYO 8                                                  OPEN PURGE |
| TEMPERATUR 120 MIN  BLOWER 2                                     VALVE 11   |
| =>290K   DONE       ENABLED                                      NIF11      |
| CY11TMP290 PGC8     BL2                                           O:057     |
|    B3      T4:28    O:027                                                   |
|---] [------] [------] [----+-------------------------------------------(U)--|
| |  523      DN        01   |                                          07    |
| |         [116]     [2:74] |                                                |
| |                          | O:057/07 - ] [ - - File #3 CRYO_REGEN - 109    |
| |                          |                    File #6 TECH_RUNGS - 16     |
| |                          |          -(L)- - File #3 CRYO_REGEN - 98       |
| |COMPRESSOR                |                                                |
| |8 REGEN-                  |                                                |
| |ERATION                   |                                                |
| |PROGRAM                   |                                                |
| |CYRGN8                    |                                                |
| |    B3                    |                                                |
| +---]/[--------------------+                                                |
|     328                                                                     |
| [63]
Rung #128
|        PURGE TIME
|        MONITOR
|        CRYO 2     CRYO 2                                                    |
|        120 MIN.   TEMPERATUR  BLOWER 2                       ROUGHING       |
|  GE 2  DONE       =>290K      ENABLED                        AND ROR 2      |
|P2      PGC2       CY2TMP290   BL2                            R&ROR2         |
|  B3      T4:22      B3        O:027                             B3          |
|---] [-----] [------] [--------] [-----------------------------------(L)-----|
|  632      DN        514        01                               642         |
|[135]    [110]                [2:74]                                         |
B3/642 - ] [ - - File #3 CRYO_REGEN -  135,164,175,176,189,196,203
                 File #6 TECH_RUNGS -  17
          -(L)- - File #3 CRYO_REGEN -  128
          -(U)- - File #3 CRYO_REGEN -  210
Rung #129
|        PURGE TIME
|        MONITOR
|        CRYO 3     CRYO 3                                                    |
|        120 MIN.   TEMPERATUR  BLOWER 2                       ROUGHING       |
|PURGE 3 DONE       =>290K      ENABLED                        AND ROR 3      |
|P3      PGC3       CY3TMP290   BL2                            R&ROR3         |
|  B3      T4:23      B3        O:027                             B3          |
|---] [-----] [------] [--------] [-----------------------------------(L)-----|
|  633      DN        515        01                               643         |
|[136]    [111]                [2:74]                                         |
B3/643 - ] [ - - File #3 CRYO_REGEN -  136,165,177,178,190,197,204
                 File #6 TECH_RUNGS -  17
          -(L)- - File #3 CRYO_REGEN -  129
          -(U)- - File #3 CRYO_REGEN -  211
Rung #130
|        PURGE TIME
|        MONITOR
|        CRYO 4     CRYO 5                                                    |
|        120 MIN    TEMPERATUR  BLOWER 2                       ROUGHING       |
|PURGE 4 DONE       =>290K      ENABLED                        AND ROR 4      |
|P4      PGC4       CY5TMP290   BL2                            R&ROR4         |
|  B3      T4:24      B3        O:027                             B3          |
|---] [-----] [------] [--------] [-----------------------------------(L)-----|
|  634      DN        517        01                               644         |
|[137]    [112]                [2:74]                                         |
```

```
B3/644 - -| |- - File #3 CRYO_REGEN -  137,166,179,180,191,198,205
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  130
       -(U)- - File #3 CRYO_REGEN -  212
```

Rung #131

```
|        PURGE TIME                                                                       |
|        MONITOR                                                                          |
|        CRYO 5     CRYO 4      CRYO 6      CRYO 7                                        |
|        120 MIN    TEMPERATUR  TEMPERATUR  TEMPERATUR  BLOWER 2              ROUGHING     |
|PURGE 5 DONE       =>290K      =>290K      =>290K      ENABLED               AND ROR 5    |
|P5      PGC5       CY4TMP290   CY6TMP290   CY7TMP290   BL2                   R&ROR5       |
|  B3      T4:25      B3          B3          B3        O:027                    B3        |
|--| |------| |-------| |---------| |---------| |--------| |---------------------(L)-------|
|  635      DN        516         518         519        01                      645       |
|[138]    [113]                                        [2:74]
B3/645 - -| |- - File #3 CRYO_REGEN -  138,167,168,169,181,182,192,199,206
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  131
       -(U)- - File #3 CRYO_REGEN -  213
```

Rung #132

```
|        PURGE TIME                                                                       |
|        MONITOR                                                                          |
|        CRYO 6     CRYO 8                                                                |
|        120 MIN    TEMPERATUR  BLOWER 2                                      ROUGHING     |
|PURGE 6 DONE       =>290K      ENABLED                                       AND ROR 6    |
|P6      PGC6       CY8TMP290   BL2                                           R&ROR6       |
|  B3      T4:26      B3        O:027                                            B3        |
|--| |------| |-------| |--------| |---------------------------------------------(L)-------|
|  636      DN        520        01                                              646       |
|[139]    [114]                [2:74]
B3/646 - -| |- - File #3 CRYO_REGEN -  139,170,183,184,193,200,207
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  132
       -(U)- - File #3 CRYO_REGEN -  214
```

Rung #133

```
|        PURGE TIME                                                                       |
|        MONITOR                                                                          |
|        CRYO 7     CRYO 9      CYRO 10     CRYO 12                                       |
|        120 MIN    TEMPERATUR  TEMPERATUR  TEMPERATUR  BLOWER 2              ROUGHING     |
|PURGE 7 DONE       =>290K      =>290K      =>290K      ENABLED               AND ROR 7    |
|P7      PGC7       CY9TMP290   CY10TMP290  CY12TMP290  BL2                   R&ROR7       |
|  B3      T4:27      B3          B3          B3        O:027                    B3        |
|--| |------| |-------| |---------| |---------| |--------| |---------------------(L)-------|
|  637      DN        521         522         524        01                      647       |
|[140]    [115]                                        [2:74]
B3/647 - -| |- - File #3 CRYO_REGEN -  140,171,172,173,185,186,194,201,208
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  133
       -(U)- - File #3 CRYO_REGEN -  215
```

ung #134

```
|        PURGE TIME                                                                       |
|        MONITOR                                                                          |
|        CRYO 8     CRYO 11                                                               |
|        120 MIN    TEMPERATUR  BLOWER 2                                      ROUGHING     |
|PURGE 8 DONE       =>290K      ENABLED                                       AND ROR 8    |
|P8      PGC8       CY11TMP290  BL2                                           R&ROR8       |
|  B3      T4:28      B3        O:027                                            B3        |
|--| |------| |-------| |--------| |---------------------------------------------(L)-------|
|  638      DN        523        01                                              648       |
|[141]    [116]                [2:74]
B3/648 - -| |- - File #3 CRYO_REGEN -  141,174,187,188,195,202,209
                 File #6 TECH_RUNGS -  17
```

```
-(L)- - File #3 CRYO_REGEN - 134
-(U)- - File #3 CRYO_REGEN - 216
Rung #135
                                 CRYO 2
  ROUGHING    BLOWER 2   TEMPERATUR                                  PURGE 2
  AND ROR 2   ENABLED    =>290K                                      P2
  R&ROR2      BL2        CY2TMP290                                     B3
     B3       0:027        B3
|---] [-------] [-------] [-------------------------------------------(U)---|
  | 642          01         514                                        632
  |[128]      [2:74]          |
  |                           | B3/632 - ] [ - File #3 CRYO_REGEN - 88, 110, 128
  |                           |              File #6 TECH_RUNGS - 15
  |COMPRESSOR                 |      -(L)- - File #3 CRYO_REGEN - 74
  |2 REGEN-                   |
  |ERATION                    |
  |PROGRAM                    |
  |CYRGN2                     |
  |      B3                   |
  |-----]/[-------------------|
        322
 [34]
Rung #136
                                 CRYO 3
  ROUGHING    BLOWER 2   TEMPERATUR                                  PURGE 3
  AND ROR 3   ENABLED    =>290K                                      P3
  R&ROR3      BL2        CY3TMP290                                     B3
     B3       0:027        B3
|---] [-------] [-------] [-------------------------------------------(U)---|
  | 643          01         515                                        633
  |[129]      [2:74]          |
  |                           | B3/633 - ] [ - File #3 CRYO_REGEN - 89, 111, 129
  |                           |              File #6 TECH_RUNGS - 15
  |COMPRESSOR                 |      -(L)- - File #3 CRYO_REGEN - 75
  |3 REGEN-                   |
  |ERATION                    |
  |PROGRAM                    |
  |CYRGN3                     |
  |      B3                   |
  |-----]/[-------------------|
        323
 [38]
Rung #137
                                 CRYO 5
  ROUGHING    BLOWER 2   TEMPERATUR                                  PURGE 4
  AND ROR 4   ENABLED    =>290K                                      P4
  R&ROR4      BL2        CY5TMP290                                     B3
     B3       0:027        B3
|---] [-------] [-------] [-------------------------------------------(U)---|
  | 644          01         517                                        634
  |[130]      [2:74]          |
  |                           | B3/634 - ] [ - File #3 CRYO_REGEN - 90, 112, 130
  |                           |              File #6 TECH_RUNGS - 15
  |COMPRESSOR                 |      -(L)- - File #3 CRYO_REGEN - 76
  |4 REGEN-                   |
  |ERATION                    |
  |PROGRAM                    |
  |CYRGN4                     |
  |      B3                   |
  |-----]/[-------------------|
        324
 [42]
```

517

```
Rung #138
|                                   CRYO 4     CRYO 6     CRYO 7
| ROUGHING   BLOWER 2   TEMPERATUR TEMPERATUR TEMPERATUR
| AND ROR 5  ENABLED    =>290K     =>290K     =>290K                          PURGE 5
| R&RORS     BL2        CY4TMP290  CY6TMP290  CY7TMP290                       P5
|    B3       O:027        B3         B3         B3                              B3
|---] [--------] [---------] [---------] [---------] [-------------------------(U)---
| |  645        01         516        518        519    |                        635
| |[131]      [2:74]                                    |
| |                                                     | B3/635 - ] [ - - File #3 CRYO_REGEN - 91, 92, 93, 113, 131
| |                                                     |                File #6 TECH_RUNGS - 15
| |COMPRESSOR                                           |         -(L)- - File #3 CRYO_REGEN - 77
| |5 REGEN-                                             |
| |ERATION                                              |
| |PROGRAM                                              |
| |CYRGN5                                               |
| |    B3                                               |
| +---]/[-----------------------------------------------+
|    325
| [46]
Rung #139
|                                   CRYO 8
| ROUGHING   BLOWER 2   TEMPERATUR
| AND ROR 6  ENABLED    =>290K                                                PURGE 6
| R&ROR6     BL2        CY8TMP290                                             P6
|    B3       O:027        B3                                                    B3
|---] [--------] [---------] [---------------------------------------------------(U)---
| |  646        01         520    |                                              636
| |[132]      [2:74]              |
| |                               | B3/636 - ] [ - - File #3 CRYO_REGEN - 94, 114, 132
| |                               |                File #6 TECH_RUNGS - 15
| |COMPRESSOR                     |         -(L)- - File #3 CRYO_REGEN - 78
| |6 REGEN-                       |
| |ERATION                        |
| |PROGRAM                        |
| |CYRGN6                         |
| |    B3                         |
| +---]/[-------------------------+
|    326
| [53]
Rung #140
|                                   CRYO 9     CYRO 10    CRYO 12
| ROUGHING   BLOWER 2   TEMPERATUR TEMPERATUR TEMPERATUR
| AND ROR 7  ENABLED    =>290K     =>290K     =>290K                          PURGE 7
| R&ROR7     BL2        CY9TMP290  CY10TMP290 CY12TMP290                      P7
|    B3       O:027        B3         B3         B3                              B3
|---] [--------] [---------] [---------] [---------] [-------------------------(U)---
| |  647        01         521        522        524    |                        637
| |[133]      [2:74]                                    |
| |                                                     | B3/637 - ] [ - - File #3 CRYO_REGEN - 95, 96, 97, 115, 133
| |                                                     |                File #6 TECH_RUNGS - 15
| |COMPRESSOR                                           |         -(L)- - File #3 CRYO_REGEN - 79
| |7 REGEN-                                             |
| |ERATION                                              |
| |PROGRAM                                              |
| |CYRGN7                                               |
| |    B3                                               |
| +---]/[-----------------------------------------------+
|    327
| [57]
```

```
Rung #141
                                 CRYO 11
  ROUGHING     BLOWER 2   TEMPERATUR                                              PURGE 8
  AND ROR 8    ENABLED    =>290K                                                  P8
  R&ROR8       BL2        CY11TMP290                                                B3
     B3         O:027        B3
 --] [-------] [-------] [--------------------------------------------------------(U)--
    648          01         523                                                    638
 [134]        [2:74]
                                 B3/638 - ] [ - File #3 CRYO_REGEN - 98, 116, 134
                                              File #6 TECH_RUNGS - 15
                                        -(L)- - File #3 CRYO_REGEN - 80
 COMPRESSOR
 8 REGEN-
 ERATION
 PROGRAM
 CYRGN8
      B3
 ----]/[----
     328
 [63]

Rung #142
 MANUAL
 CONTROL                                                               MANUAL CRYO
 CRYO ROUGH                                                            ROUGH 2
 VALVE 2                                                               OPEN
 OPEN                                                                  MCR2OP
 M-CR2-1                                                                  N7:33
   N7:12
 ---] [---------------------------------------------------------------------(L)--
     10                                                                     10
 [2:3]                                                                 MANUAL CRYO
 N7:33/10 - ] [ - File #3 CRYO_REGEN - 164                             ROUGH 2
            -(U)- - File #3 CRYO_REGEN - 143                           CLOSE
 _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                           MCR2CL
 N7:28/10 - -(L)- - File #3 CRYO_REGEN - 143                              N7:28
 _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                           ----(U)--
                                                                          10

Rung #143
  MANUAL
  CONTROL                                                              MANUAL CRYO
  CLOSE CRYO                                                           ROUGH 2
  ROUGH                                                                OPEN
  VALVE 2                                                              MCR2OP
  M-CR2-0                                                                 N7:33
      N7:7
 ------] [-------------------------------------------------------------------(U)--
        10                                                                  10
  [2:3]
                     N7:33/10 - ] [ - File #3 CRYO_REGEN - 164         MANUAL CRYO
                                -(L)- - File #3 CRYO_REGEN - 142       ROUGH 2
                     _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2       CLOSE
                     N7:28/10 - -(U)- - File #3 CRYO_REGEN - 142       MCR2CL
                     _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2          N7:28
  COMPRESSOR                                                           ----(L)--
  2 REGEN-     CRYO 2                                                     10
  ERATION      TEMPERATUR
  PROGRAM      =<20K
  CYRGN2       CY2TMP20
      B3           B3
  ----]/[-------] [----
     322          502
  [238]
```

```
Rung #144
|MANUAL
|CONTROL
|CRYO ROUGH                                                    MANUAL CRYO
|VALVE 3                                                       ROUGH 3
|OPEN                                                          OPEN
|N-CR3-1                                                       MCR3OP
|  N7:12                                                          N7:33
|---] [----------------------------------------------------------(L)---
|    11                                                            11
|[2:3]                                                         |MANUAL CRYO
| N7:33/11 - -] [- - File #3 CRYO_REGEN - 165                  |ROUGH 3
|            -(U)- - File #3 CRYO_REGEN - 145                  |CLOSE
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |MCR3CL
| N7:28/11 - -(L)- - File #3 CRYO_REGEN - 145                  |  N7:28
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  ---(U)---
|                                                                  11
Rung #145
| MANUAL
| CONTROL
| CLOSE CRYO                                                   MANUAL CRYO
| ROUGH                                                        ROUGH 3
| VALVE 3                                                      OPEN
| N-CR3-0                                                      MCR3OP
|     N7:7                                                        N7:33
|-------] [----------------------------------------------------------(U)---
|        11                                                        11
| |[2:3]
| |                     | N7:33/11 - -] [- - File #3 CRYO_REGEN - 165
| |                     |             -(L)- - File #3 CRYO_REGEN - 144   |MANUAL CRYO
| |COMPRESSOR           | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2   |ROUGH 3
| |3 REGEN-   CRYO 3    | N7:28/11 - -(U)- - File #3 CRYO_REGEN - 144   |CLOSE
| |ERATION    TEMPERATUR| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2   |MCR3CL
| |PROGRAM    =<20K     |                                               |  N7:28
| |CYRGN3     CY3TMP20  |                                               ---(L)---
| |   B3         B3     |                                                  11
| |---]/[--------] [----|
|     323        503
|  [239]
Rung #146
|MANUAL
|CONTROL
|CRYO ROUGH                                                    MANUAL CRYO
|VALVE 4                                                       ROUGH 4
|OPEN                                                          OPEN
|M-CR4-1                                                       MCR4OP
|  N7:12                                                          N7:33
|---] [----------------------------------------------------------(L)---
|    12                                                            12
|[2:3]                                                         |MANUAL CRYO
| N7:33/12 - -] [- - File #3 CRYO_REGEN - 167                  |ROUGH 4
|            -(U)- - File #3 CRYO_REGEN - 147                  |CLOSE
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |MCR4CL
| N7:28/12 - -(L)- - File #3 CRYO_REGEN - 147                  |  N7:28
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  ---(U)---
|                                                                  12
```

```
Rung #147
| MANUAL                                                          MANUAL CRYO
| CONTROL                                                         ROUGH 4
| CLOSE CRYO                                                      OPEN
| ROUGH                                                           MCR4OP
| VALVE 4                                                            N7:33
| M-CR4-O                                                        ----(U)----
|     N7:7                                                             12
|----| |----
       12
 [2:3]                N7:33/12 - -| |- - File #3 CRYO_REGEN - 167
                              -(L)- - File #3 CRYO_REGEN - 146     MANUAL CRYO
                      _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  ROUGH 4
 COMPRESSOR           N7:28/12 - -(U)- - File #3 CRYO_REGEN - 146  CLOSE
 5 REGEN-   CRYO 4    _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  MCR4CL
 ERATION    TEMPERATUR                                               N7:28
 PROGRAM    =<20K                                                ----(L)----
 CYRGN5     CY4TMP20                                                   12
     B3         B3
 ---|/|--------| |---
    325        504
 [241]

Rung #148
|MANUAL                                                           MANUAL CRYO
|CONTROL                                                          ROUGH 5
|CRYO ROUGH                                                       OPEN
 OPEN                                                             MCR5OP
 M-CR5-1                                                             N7:33
|   N7:12                                                        ----(L)----
|----| |----                                                           13
      13
 [2:3]                                                            MANUAL CRYO
 N7:33/13 - -| |- - File #3 CRYO_REGEN - 166                      ROUGH 5
          -(U)- - File #3 CRYO_REGEN - 149                        CLOSE
 _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      MCR5CL
 N7:28/13 - -(L)- - File #3 CRYO_REGEN - 149                         N7:28
 _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                     ----(U)----
                                                                       13

Rung #149
| MANUAL                                                          MANUAL CRYO
| CONTROL                                                         ROUGH 5
| CLOSE CRYO                                                      OPEN
| ROUGH                                                           MCR5OP
| VALVE 5                                                            N7:33
| M-CR5-O                                                        ----(U)----
|     N7:7                                                             13
|----| |----
       13
 [2:3]                N7:33/13 - -| |- - File #3 CRYO_REGEN - 166
                              -(L)- - File #3 CRYO_REGEN - 148     MANUAL CRYO
                      _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  ROUGH 5
 COMPRESSOR           N7:28/13 - -(U)- - File #3 CRYO_REGEN - 148  CLOSE
 4 REGEN-   CRYO 5    _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  MCR5CL
 ERATION    TEMPERATUR                                               N7:28
 PROGRAM    =<20K                                                ----(L)----
 CYRGN4     CY5TMP20                                                   13
     B3         B3
 ---|/|--------| |---
    324        505
 [240]
```

```
Rung #150
|MANUAL
|CONTROL
|CRYO ROUGH                                                        MANUAL CRYO
|VALVE 6                                                           ROUGH 6
|OPEN                                                              OPEN
|M-CR6-1                                                           MCR6OP
|  N7:12                                                              N7:33
|---] [-------------------------------------------------------------+--(L)--+-
|   14                                                              |   14   |
|[2:3]                                                              |        |
| N7:33/14 - -] [- - File #3 CRYO_REGEN - 168                       |MANUAL CRYO
|            -(U)- - File #3 CRYO_REGEN - 151                       |ROUGH 6
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |CLOSE
| N7:28/14 - -(L)- - File #3 CRYO_REGEN - 151                       |MCR6CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |   N7:28
|                                                                   +--(U)--+
|                                                                       14

Rung #151
| MANUAL
| CONTROL
| CLOSE CRYO                                                       MANUAL CRYO
| ROUGH                                                            ROUGH 6
| VALVE 6                                                          OPEN
| M-CR6-O                                                          MCR6OP
|      N7:7                                                           N7:33
+-+---] [-----------+-----------------------------------------------+--(U)--+-
| |     14          |                                               |   14   |
| |[2:3]            |                                               |        |
| |                 | N7:33/14 - -] [- - File #3 CRYO_REGEN - 168   |        |
| |                 |           -(L)- - File #3 CRYO_REGEN - 150    |MANUAL CRYO
| |COMPRESSOR       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2   |ROUGH 6
| |S REGEN-   CRYO 6| N7:28/14 - -(U)- - File #3 CRYO_REGEN - 150   |CLOSE
| |ERATION TEMPERATUR| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  |MCR6CL
| |PROGRAM    =<20K |                                               |   N7:28
| |CYRGNS   CY6TMP20|                                               +--(L)--+
| |   B3        B3  |                                                   14
| +--]/[-------] [--+
|   325        506
| [241]

Rung #152
|MANUAL
|CONTROL
|CRYO ROUGH                                                        MANUAL CRYO
|VALVE 7                                                           ROUGH 7
|OPEN                                                              OPEN
|M-CR7-1                                                           MCR7OP
|  N7:12                                                              N7:33
|---] [-------------------------------------------------------------+--(L)--+-
|   15                                                              |   15   |
|[2:3]                                                              |        |
| N7:33/15 - -] [- - File #3 CRYO_REGEN - 169                       |MANUAL CRYO
|           -(U)- - File #3 CRYO_REGEN - 153                        |ROUGH 7
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |CLOSE
| N7:28/15 - -(L)- - File #3 CRYO_REGEN - 153                       |MCR7CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |   N7:28
|                                                                   +--(U)--+
|                                                                       15
```

522

Rung #153

MANUAL CONTROL CLOSE CRYO ROUGH VALVE 7 M-CR7-0 N7:7 15 [2:3]

COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5 B3 325 (/)

CRYO 7 TEMPERATUR =<20K CY7TMP20 B3 507

[241]

```
N7:33/15 - -| |- - File #3 CRYO_REGEN - 169
            -(L)- - File #3 CRYO_REGEN - 152
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
N7:28/15 - -(U)- - File #3 CRYO_REGEN - 152
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
```

MANUAL CRYO ROUGH 7 OPEN MCR7OP N7:33 -(U)- 15

MANUAL CRYO ROUGH 7 CLOSE MCR7CL N7:28 -(L)- 15

Rung #154

MANUAL CONTROL CRYO ROUGH VALVE 8 OPEN M-CR8-1 N7:13 0

[2:3]

```
N7:34/0 - -| |- - File #3 CRYO_REGEN - 170
          -(U)- - File #3 CRYO_REGEN - 155
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/0 - -(L)- - File #3 CRYO_REGEN - 155
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
```

MANUAL CRYO ROUGH 8 OPEN MCR8OP N7:34 -(L)- 0

MANUAL CRYO ROUGH 8 CLOSE MCR8CL N7:29 -(U)- 0

Rung #155

MANUAL CONTROL CLOSE CRYO ROUGH VALVE 8 M-CR8-0 N7:8 0 [2:3]

COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6 B3 326 (/)

CRYO 8 TEMPERATUR =<20K CY8TMP20 B3 508

[242]

```
N7:34/0 - -| |- - File #3 CRYO_REGEN - 170
          -(L)- - File #3 CRYO_REGEN - 154
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/0 - -(U)- - File #3 CRYO_REGEN - 154
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
```

MANUAL CRYO ROUGH 8 OPEN MCR8OP N7:34 -(U)- 0

MANUAL CRYO ROUGH 8 CLOSE MCR8CL N7:29 -(L)- 0

523

```
Rung #156
|MANUAL
|CONTROL
|CRYO ROUGH                                                    MANUAL CRYO
|VALVE 9                                                       ROUGH 9
|OPEN                                                          OPEN
|M-CR9-1                                                       MCR9OP
|  N7:13                                                          N7:34
|---] [--------------------------------------------------------+---(L)---+
|    1                                                         |    1    |
|[2:3]                                                         |         |
| N7:34/1 - ] [ - File #3 CRYO_REGEN - 171                     |         |
|          -(U)- - File #3 CRYO_REGEN - 157                    |         |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                  |         |
| N7:29/1 - -(L)- - File #3 CRYO_REGEN - 157                   | N7:29   |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                  +--(U)----+
|                                                                  1
Rung #157
| MANUAL
| CONTROL
| CLOSE CRYO                                                   MANUAL CRYO
| ROUGH                                                        ROUGH 9
| VALVE 9                                                      OPEN
| M-CR9-O                                                      MCR9OP
|     N7:8                                                        N7:34
|  ---] [------------+-----------------------------------------+---(U)---+
|        1           |                                         |    1    |
| |[2:3]             |                                         |         |
| |                  | N7:34/1 - ] [ - File #3 CRYO_REGEN - 171|         |
| |                  |          -(L)- - File #3 CRYO_REGEN - 156         |
| |COMPRESSOR        | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2       |
| |7 REGEN-   CRYO 9 | N7:29/1 - -(U)- - File #3 CRYO_REGEN - 156        |
| |ERATION    TEMPERATUR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2    |
| |PROGRAM    =<20K  |                                         | N7:29   |
| |CYRGN7     CY9TMP20                                         +--(L)----+
| |    B3        B3  |                                             1
| +---]/[------] [---+
|     327      509
| [243]
Rung #158
|MANUAL
|CONTROL
|CRYO ROUGE                                                    MANUAL CRYO
|VALVE 10                                                      ROUGH 10
|OPEN                                                          OPEN
|M-CR10-1                                                      MCR10OP
|  N7:13                                                          N7:34
|---] [--------------------------------------------------------+---(L)---+
|    2                                                         |    2    |
|[2:3]                                                         |         |
| N7:34/2 - ] [ - File #3 CRYO_REGEN - 172                     |         |
|          -(U)- - File #3 CRYO_REGEN - 159                    |         |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                  |         |
| N7:29/2 - -(L)- - File #3 CRYO_REGEN - 159                   | N7:29   |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                  +--(U)----+
|                                                                  2
```

```
Rung #159
| MANUAL
| CONTROL
| CLOSE CRYO                                                         MANUAL CRYO
| ROUGH                                                              ROUGH 10
| VALVE 10                                                           OPEN
| M-CR10-0                                                           MCR10OP
|      N7:8                                                              N7:34
|-+----| |----+--------------------------------------------------------+---(U)---+-|
| |      2    |                                                        |    2    |
| |[2:3]      |                                                        |         |
| |           | N7:34/2 - -| |- - File #3 CRYO_REGEN - 172             |         |
| |           |           -(L)- - File #3 CRYO_REGEN - 158             |         |
| |COMPRESSOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2            |         |
| |7 REGEN-    CRYO 10 | N7:29/2 - -(U)- - File #3 CRYO_REGEN - 158    |         |
| |ERATION     TEMPERATUR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 |      |
| |PROGRAM     =<20K  |                                                | N7:29   |
| |CYRGN7      CY10TMP20 |                                             +--(L)----+
| |  B3          B3   |                                                   2
| +--|/|---------| |--+
|    327         510
| [243]
Rung #160
|MANUAL
|CONTROL                                                             MANUAL CRYO
|CRYO 11                                                             ROUGH 11
|OPEN                                                                OPEN
  CR11-1                                                             MCR11OP
| N7:13                                                                  N7:34
|--| |-----------------------------------------------------------------+---(L)---+-|
|   3                                                                  |    3    |
|[2:3]                                                                 |         |
| N7:34/3 - -| |- - File #3 CRYO_REGEN - 174                           |         |
|           -(U)- - File #3 CRYO_REGEN - 161                           |         |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                          |         |
| N7:29/3 - -(L)- - File #3 CRYO_REGEN - 161                           | N7:29   |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                          +--(U)----+
|                                                                         3
Rung #161
| MANUAL
| CONTROL                                                            MANUAL CRYO
| CLOSE CRYO                                                         ROUGH 11
| ROUGH                                                              OPEN
| VALVE 11                                                           MCR11OP
| M-CR11-0                                                               N7:34
|      N7:8                                                       
|-+----| |----+--------------------------------------------------------+---(U)---+-|
| |      3    |                                                        |    3    |
|  [2:3]      |                                                        |         |
| |           | N7:34/3 - -| |- - File #3 CRYO_REGEN - 174             |         |
| |           |           -(L)- - File #3 CRYO_REGEN - 160             |         |
| |COMPRESSOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2            |         |
| |8 REGEN-    CRYO 11 | N7:29/3 - -(U)- - File #3 CRYO_REGEN - 160    |         |
| |ERATION     TEMPERATUR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 |      |
| |PROGRAM     =<20K  |                                                | N7:29   |
| |CYRGN8      CY11TMP20 |                                             +--(L)----+
| |  B3          B3   |                                                   3
| +--|/|---------| |--+
|    328         511
| [244]
```

```
Rung #162
|MANUAL
|CONTROL
|CRYO ROUGH                                                        MANUAL CRYO
|VALVE 12                                                          ROUGH 12
|OPEN                                                              OPEN
|N-CR12-1                                                          MCR12OP
|  N7:13                                                              N7:34
|---] [-------------------------------------------------------------+---(L)---+-|
|    4                                                              |    4    | |
|[2:3]                                                              |         | |
| N7:34/4 - -] [- - File #3 CRYO_REGEN - 173                         |         | |
|           -(U)- - File #3 CRYO_REGEN - 163                         |         | |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |         | |
| N7:29/4 - -(L)- - File #3 CRYO_REGEN - 163                         |  N7:29  | |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        +---(U)---+ |
|                                                                       4        |

Rung #163
|  MANUAL
|  CONTROL
|  CLOSE CRYO                                                      MANUAL CRYO
|  ROUGH                                                           ROUGH 12
|  VALVE 12                                                        OPEN
|  N-RV12-0                                                        MCR12OP
|     N7:8                                                            N7:34
|-+---] [------------+----------------------------------------------+---(U)---+-|
| |    4             |                                              |    4    | |
| |[2:3]             |                                              |         | |
| |                  | N7:34/4 - -] [- - File #3 CRYO_REGEN - 173    |         | |
| |                  |           -(L)- - File #3 CRYO_REGEN - 162    |         | |
| |COMPRESSOR        | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2   |         | |
| |7 REGEN-  CRYO 12 | N7:29/4 - -(U)- - File #3 CRYO_REGEN - 162    |         | |
| |ERATION   TEMPERATUR _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2  |         | |
| |PROGRAM   =<20K    |                                              |  N7:29  | |
| |CYRGN7    CY12TMP20 |                                             +---(L)---+ |
| |   B3        B3   |                                                  4        |
| +---]/[------] [---+                                                           |
|    327       512                                                               |
|  [243]                                                                         |
```

526

```
Rung #164
                                                 CRYO 2                                       OPEN
 ROUGHING     COMPRESSOR 2     LINE PRESSURE     THERMCOUPL     BLOWER 2                    CRYO ROUGH
 AND ROR 2    ROR LATCH        MADE-TC10         50 MICRON      ENABLED                     VALVE 2
 R&ROR2       CY2RORL          LPM-TC10          PIR4           BL2                         CR2
    B3            B3               B3            I:004          O:027                          O:007
|---] [-----------]/[--------+------] [------------]/[------------] [-----------------------------( )---+
|   642           602        |     250             12             01                             12     |
| [128]         [175]        |  [2:671]                         [2:74]                                  |
|                            |  O:007/12 - -] [- - File #3 CRYO_REGEN - 36                  CRYOPUMP 2 |
|                            |                    File #6 TECH_RUNGS - 14                   ROUGHING TIMER
| MANUAL CRYO   CRYO 2       |             -]/[- - File #2 MAIN_PRGRM - 117, 118, 387        CR2RUF_TMR |
| ROUGH 2       TEMPERATUR   |                    File #3 CRYO_REGEN - 88                   +-TON------------+
| OPEN          =<20K        |  T4:172.DN - -] [- - File #3 CRYO_REGEN - 31                 +TIMER ON DELAY  +-(EN)-
| MCR2OP        CY2TMP20     |                                                              |TIMER:    T4:172|
|   N7:33         B3         |                                                              |BASE (SEC):  1.0+-(DN)
|---] [-----------]/[--------+                                                              |PRESET:      600|
|   10            502        |                                                              |ACCUM:         0|
| [143]                      |                                                              +----------------+
|                            |
| COOL DOWN                  |
| 2                          |
| CD2                        |
|   B3                       |
|---] [----------------------+
    652
  [203]

Rung #165
                                                 CRYO 3                                       OPEN
 ROUGHING     COMPRESSOR 3     LINE PRESSURE     THERMCOUPL     BLOWER 2                    CRYO ROUGH
 AND ROR 3    ROR LATCH        MADE-TC10         50 MICRON      ENABLED                     VALVE 3
 R&ROR3       CY3RORL          LPM-TC10          PIR5           BL2                         CR3
    B3            B3               B3            I:004          O:027                          O:007
|---] [-----------]/[--------+------] [------------]/[------------] [-----------------------------( )---+
|   643           603        |     250             13             01                             13     |
| [129]         [177]        |  [2:671]                         [2:74]                                  |
|                            |  O:007/13 - -] [- - File #3 CRYO_REGEN - 40                  CRYO REGEN 3 |
|                            |                    File #6 TECH_RUNGS - 14                   ROUGHING TIMER
| MANUAL CRYO   CRYO 3       |             -]/[- - File #2 MAIN_PRGRM - 119, 120, 387        CR3RUF_TMR |
| ROUGH 3       TEMPERATUR   |                    File #3 CRYO_REGEN - 89                   +-TON------------+
| OPEN          =<20K        |  T4:173.DN - -] [- - File #3 CRYO_REGEN - 31                 +TIMER ON DELAY  +-(EN)-
| MCR3OP        CY3TMP20     |                                                              |TIMER:    T4:173|
|   N7:33         B3         |                                                              |BASE (SEC):  1.0+-(DN)
|---] [-----------]/[--------+                                                              |PRESET:      600|
|   11            503        |                                                              |ACCUM:         0|
| [145]                      |                                                              +----------------+
|                            |
| COOL DOWN                  |
| 3                          |
| CD3                        |
|   B3                       |
|---] [----------------------+
    653
  [204]
```

527

```
Rung #166
|                                                      CRYO 5                                                 OPEN               |
| ROUGHING   COMPRESSOR 4   LINE PRESSURE  THERMCOUPL  BLOWER 2                                               CRYO ROUGH         |
| AND ROR 4  ROR LATCH      MADE-TC10      50 MICRON   ENABLED                                                VALVE 5            |
| R&ROR4     CY4RORL        LPM-TC10       PIR8        BL2                                                    CR5                |
|    B3          B3              B3         I:024      O:027                                                    O:027           |
|----] [---------]/[-------------] [--------]/[--------] [------------------------------------------------+-------( )---------+--|
| |  644         604        |    250          11         01                                              |       12         |  |
| | [130]       [179]       | [2:671]                  [2:74]                                            |                  |  |
| |                         | O:027/12 - -] [- - File #3 CRYO_REGEN - 44                                   |                  |  |
| |                         |                    File #6 TECH_RUNGS - 14                                   |CRYO REGEN 5      |  |
| |MANUAL CRYO  CRYO 5      |              -]/[- - File #2 MAIN_PRGRM - 123, 124, 387                     |ROUGHING TIMER    |  |
| |ROUGH 5      TEMPERATUR  |                    File #3 CRYO_REGEN - 90                                   |CR5RUF_TMR        |  |
| |OPEN         =<20K       | T4:175.DN - -] [- - File #3 CRYO_REGEN - 31                                  | +-TON----------+ |  |
| |MCR5OP       CY5TMP20    |                                                                              +-|TIMER ON DELAY |-(EN)-+  |
| |   N7:33         B3      |                                                                                |TIMER:   T4:175|         |
| |----] [---------]/[------|                                                                                |BASE (SEC):  1.0|-(DN)   |
| |    13          505      |                                                                                |PRESET:     600|         |
| | [149]                   |                                                                                |ACCUM:        0|         |
| |                         |                                                                                +---------------+         |
| |COOL DOWN                |                                                                                                          |
| |4                        |                                                                                                          |
| |CD4                      |                                                                                                          |
| |   B3                    |                                                                                                          |
| +---] [-------------------+                                                                                                          |
|    654                                                                                                                               |
|  [205]                                                                                                                               |
Rung #167
|                                                      CRYO 4                                                 OPEN               |
| ROUGHING   COMPRESSOR 5   LINE PRESSURE  THERMCOUPL  BLOWER 2                                               CRYO ROUGH         |
| AND ROR 5  ROR LATCH      MADE-TC10      50 MICRON   ENABLED                                                VALVE 4            |
| R&ROR5     CY5RORL        LPM-TC10       PIR7        BL2                                                    CR4                |
|    B3          B3              B3         I:024      O:027                                                    O:027           |
|----] [---------]/[-------------] [--------]/[--------] [------------------------------------------------+-------( )---------+--|
| |  645         605        |    250          10         01                                              |       11         |  |
| | [131]       [181]       | [2:671]                  [2:74]                                            |                  |  |
| |                         | O:027/11 - -] [- - File #3 CRYO_REGEN - 48                                   |                  |  |
| |                         |                    File #6 TECH_RUNGS - 14                                   |CRYO REGEN 4      |  |
| |MANUAL CRYO  CRYO 4      |              -]/[- - File #2 MAIN_PRGRM - 121, 122, 387                     |ROUGHING TIMER    |  |
| |ROUGH 4      TEMPERATUR  |                    File #3 CRYO_REGEN - 91                                   |CR4RUF_TMR        |  |
| |OPEN         =<20K       | T4:174.DN - -] [- - File #3 CRYO_REGEN - 31                                  | +-TON----------+ |  |
| |MCR4OP       CY4TMP20    |                                                                              +-|TIMER ON DELAY |-(EN)-+  |
| |   N7:33         B3      |                                                                                |TIMER:   T4:174|         |
| |----] [---------]/[------|                                                                                |BASE (SEC):  1.0|-(DN)   |
| |    12          504      |                                                                                |PRESET:     600|         |
| | [147]                   |                                                                                |ACCUM:        0|         |
| |                         |                                                                                +---------------+         |
| |COOL DOWN                |                                                                                                          |
| |5                        |                                                                                                          |
| |CD5                      |                                                                                                          |
| |   B3                    |                                                                                                          |
| +---] [-------------------+                                                                                                          |
|    655                                                                                                                               |
|  [206]                                                                                                                               |
```

```
Rung #168
                                                     CRYO 6                                       OPEN
  ROUGHING      COMPRESSOR 5    LINE PRESSURE    THERMCOUPL   BLOWER 2                            CRYO ROUGH
  AND ROR 5     ROR LATCH       MADE-TC10        50 MICRON    ENABLED                             VALVE 6
  R&RORS        CY5RORL         LPM-TC10         PIR9         BL2                                 CR6
     B3            B3               B3           I:024        O:027                                 O:027
 ---] [-----------]/[---------------] [-----------]/[----------] [-----------------------------------( )---
     645           605              250           12           01                                   13
  [131]         [181]           [2:671]                      [2:74]
                                O:027/13 - ] [ - File #3 CRYO_REGEN - 49
                                                 File #6 TECH_RUNGS - 14
                                           ]/[ - File #2 MAIN_PRGRM - 125, 126, 387              CRYO REGEN 6
                                                 File #3 CRYO_REGEN - 92                         ROUGHING TIMER
  MANUAL CRYO   CRYO 6          T4:176.DN - ] [ - File #3 CRYO_REGEN - 31                        CR6RUF_TMR
  ROUGH 6       TEMPERATUR                                                                        +--TON------------+
  OPEN          =<20K                                                                             |TIMER ON DELAY   |-(EN)-
  MCR6OP        CY6TMP20                                                                          |TIMER:    T4:176 |
     N7:33         B3                                                                             |BASE (SEC):  1.0 |-(DN)
 ----] [----------]/[----                                                                         |PRESET:      600 |
      14           506                                                                            |ACCUM:         0 |
  [151]                                                                                           +-----------------+

  COOL DOWN
  5
  CD5
     B3
 ----] [----
     655
  [206]

Rung #169
                                                     CRYO 7                                       OPEN
  ROUGHING      COMPRESSOR 5    LINE PRESSURE    THERMCOUPL   BLOWER 2                            CRYO ROUGH
  AND ROR 5     ROR LATCH       MADE-TC10        50 MICRON    ENABLED                             VALVE 7
  R&RORS        CY5RORL         LPM-TC10         PIR12        BL2                                 CR7
     B3            B3               B3           I:040        O:027                                 O:043
 ---] [-----------]/[---------------] [-----------]/[----------] [-----------------------------------( )---
     645           605              250           10           01                                   11
  [131]         [181]           [2:671]                      [2:74]
                                O:043/11 - ] [ - File #3 CRYO_REGEN - 50
                                                 File #6 TECH_RUNGS - 14                         CRYO REGEN 7
                                           ]/[ - File #2 MAIN_PRGRM - 127, 128, 388              ROUGHING TIMER
                                                 File #3 CRYO_REGEN - 93                         CR7RUF_TMR
  MANUAL CRYO   CRYO 7          T4:177.DN - ] [ - File #3 CRYO_REGEN - 31                        +--TON------------+
  ROUGH 7       TEMPERATUR                                                                        |TIMER ON DELAY   |-(EN)-
  OPEN          =<20K                                                                             |TIMER:    T4:177 |
  MCR7OP        CY7TMP20                                                                          |BASE (SEC):  1.0 |-(DN)
     N7:33         B3                                                                             |PRESET:      600 |
 ----] [----------]/[----                                                                         |ACCUM:         0 |
      15           507                                                                            +-----------------+
  [153]

  COOL DOWN
  5
  CD5
     B3
 ----] [----
     655
  [206]
```

529

```
Rung #170
ROUGHING   COMPRESSOR 6   LINE PRESSURE   CRYO 8        BLOWER 2                      OPEN
AND ROR 6  ROR LATCH      MADE-TC10       THERMCOUPL    ENABLED                       CRYO ROUGH
R&ROR6     CY6RORL        LPM-TC10        50 MICRON     BL2                           VALVE 8
                                          PIR13                                       CR8
B3         B3             B3              I:040         O:027                         O:043
--] [------]/[-----------] [-------------]/[-----------] [-----------------------------( )--
646        606            250             11            01                            12
[132]      [183]          [2:671]                       [2:74]
                          O:043/12 - ] [ - File #3 CRYO_REGEN - 55
                                           File #6 TECH_RUNGS - 14                    CRYO REGEN 8
MANUAL CRYO  CRYO 8                  ]/[ - File #2 MAIN_PRGRM - 129, 130, 388         ROUGHING TIMER
ROUGH 8      TEMPERATUR                    File #3 CRYO_REGEN - 94                    CR8RUF_TMR
OPEN         =<20K        T4:178.DN - ] [ - File #3 CRYO_REGEN - 31                   TON
MCR8OP       CY8TMP20                                                                 TIMER ON DELAY  -(EN)-
N7:34        B3                                                                       TIMER:      T4:178
--] [--------]/[--                                                                    BASE (SEC):    1.0 -(DN)
0            508                                                                      PRESET:        600
[155]                                                                                 ACCUM:           0
COOL DOWN
6
CD6
B3
--] [--
656
[207]

Rung #171
ROUGHING   COMPRESSOR 7   LINE PRESSURE   CRYO 9        BLOWER 2                      OPEN
AND ROR 7  ROR LATCH      MADE-TC10       THERMCOUPL    ENABLED                       CRYO ROUGH
R&ROR7     CY7RORL        LPM-TC10        50 MICRON     BL2                           VALVE 9
                                          PIR14                                       CR9
B3         B3             B3              I:040         O:027                         O:043
--] [------]/[-----------] [-------------]/[-----------] [-----------------------------( )--
647        607            250             12            01                            13
[133]      [185]          [2:671]                       [2:74]
                          O:043/13 - ] [ - File #3 CRYO_REGEN - 59
                                           File #6 TECH_RUNGS - 14                    CRYO REGEN 9
MANUAL CRYO  CRYO 9                  ]/[ - File #2 MAIN_PRGRM - 131, 132, 388         ROUGHING TIMER
ROUGH 9      TEMPERATUR                    File #3 CRYO_REGEN - 95                    CR9RUF_TMR
OPEN         =<20K        T4:179.DN - ] [ - File #3 CRYO_REGEN - 31                   TON
MCR9OP       CY9TMP20                                                                 TIMER ON DELAY  -(EN)-
N7:34        B3                                                                       TIMER:      T4:179
--] [--------]/[--                                                                    BASE (SEC):    1.0 -(DN)
1            509                                                                      PRESET:        600
[157]                                                                                 ACCUM:           0
COOL DOWN
7
D7
B3
--] [--
657
[208]
```

```
Rung #172
                                                     CRYO 10                                           OPEN
  ROUGHING     COMPRESSOR 7    LINE PRESSURE   THERMCOUPL   BLOWER 2                                  CRYO ROUGH
  AND ROR 7    ROR LATCH       MADE-TC10       50 MICRON    ENABLED                                   VALVE 10
  R&ROR7       CY7RORL         LPM-TC10        PIR18        BL2.                                      CR10
     B3           B3              B3           I:054        O:027                                       O:057
 ----] [---------]/[---------------] [-----------]/[----------] [--------------------------------------+---( )---+
    647          607              250            11           01                                     |    11    |
  [133]        [185]           [2:671]                      [2:74]                                   |          |
                               O:057/11 - -] [- - File #3 CRYO_REGEN - 60                            |          |
                                                  File #6 TECH_RUNGS - 14                            CRYO REGEN 10
                                          -]/[- - File #2 MAIN_PRGRM - 133, 134, 388                 ROUGHING TIMER
                                                  File #3 CRYO_REGEN - 96                            CR10RUF_TMR
  MANUAL CRYO  CRYO 10         T4:180.DN - -] [- - File #3 CRYO_REGEN - 31                           +-TON------------+
  ROUGH 10     TEMPERATUR                                                                            |TIMER ON DELAY  |-(EN)-
  OPEN         =<20K                                                                                 |TIMER:   T4:180 |
  MCR10OP      CY10TMP20                                                                             |BASE (SEC):  1.0|-(DN)
     N7:34        B3                                                                                 |PRESET:     600 |
  ----] [---------]/[----                                                                            |ACCUM:        0 |
      2           510                                                                                +----------------+
  [159]

  COOL DOWN
  7
  CD7
     B3
  ----] [----
     657
  [208]

Rung #173
                                                     CRYO 12                                           OPEN
  ROUGHING     COMPRESSOR 7    LINE PRESSURE   THERMCOUPL   BLOWER 2                                  CRYO ROUGH
  AND ROR 7    ROR LATCH       MADE-TC10       50 MICRON    ENABLED                                   VALVE 12
  R&ROR7       CY7RORL         LPM-TC10        PIR20        BL2                                       CR12
     B3           B3              B3           I:054        O:027                                       O:057
 ----] [---------]/[---------------] [-----------]/[----------] [--------------------------------------+---( )---+
    647          607              250            13           01                                     |    13    |
  [133]        [185]           [2:671]                      [2:74]                                   |          |
                               O:057/13 - -] [- - File #3 CRYO_REGEN - 61                            |          |
                                                  File #6 TECH_RUNGS - 14                            CRYO REGEN 12
  MANUAL CRYO  CRYO 12                    -]/[- - File #2 MAIN_PRGRM - 137, 138, 388                 ROUGHING TIMER
  ROUGH 12     TEMPERATUR                         File #3 CRYO_REGEN - 97                            CR12RUF_TMR
  OPEN         =<20K           T4:182.DN - -] [- - File #3 CRYO_REGEN - 31                           +-TON------------+
  MCR12OP      CY12TMP20                                                                             |TIMER ON DELAY  |-(EN)-
     N7:34        B3                                                                                 |TIMER:   T4:182 |
  ----] [---------]/[----                                                                            |BASE (SEC):  1.0|-(DN)
      4           512                                                                                |PRESET:     600 |
  [163]                                                                                              |ACCUM:        0 |
                                                                                                     +----------------+
  COOL DOWN
  7
  D7
     B3
  ----] [----
     657
  [208]
```

```
Rung #174
                                                    CRYO 11                                              OPEN
  ROUGHING   COMPRESSOR 8     LINE PRESSURE  THERMCOUPL  BLOWER 2                                        CRYO ROUGH
  AND ROR 8  ROR LATCH        MADE-TC10      50 MICRON   ENABLED                                         VALVE 11
  R&ROR8     CY8RORL          LPM-TC10       PIR19       BL2                                             CR11
    B3          B3              B3           I:054       O:027                                             O:057
|--] [--------]/[----------+----] [---------]/[--------] [--------------------------------------------+-----( )----+
    648        608         |    250            12          01                                         |     12
  [134]       [187]        | [2:671]                   [2:74]                                         |
                           | O:057/12 - ] [ - File #3 CRYO_REGEN - 65                                 |
                           |                File #6 TECH_RUNGS - 14                                   |CRYO REGEN 11
 MANUAL CRYO   CRYO 11     |          ]/[ - File #2 MAIN_PRGRM - 135, 136, 388                        |ROUGHING TIMER
 ROUGH 11      TEMPERATUR  |                File #3 CRYO_REGEN - 98                                   |CR11RUF_TMR
 OPEN          =<20K       | T4:181.DN - ] [ - File #3 CRYO_REGEN - 31                                |+-TON---------------+
 MCR11OP       CY11TMP20   |                                                                          +|TIMER ON DELAY     |-(EN)-
   N7:34          B3       |                                                                           |TIMER:       T4:181|
|---] [----------]/[-------+                                                                           |BASE (SEC):     1.0|-(DN)
     3           511       |                                                                           |PRESET:         600|
 [161]                     |                                                                           |ACCUM:            0|
                           |                                                                           +-------------------+
 COOL DOWN                 |
 8                         |
 CD8                       |
   B3                      |
|---] [--------------------+
   658
 [209]
ng #175
            CRYO 2                      CRYO 2
ROUGHING    THERMCOUPL  BLOWER 2   ROR LATCH                                                             COMPRESSOR 2
AND ROR 2   50 MICRON   ENABLED    ONE SHOT                                                              ROR LATCH
R&ROR2      PIR4        BL2        C2RORLOS                                                              CY2RORL
  B3        I:004       O:027        B3                                                                    B3
|--] [--------] [--------] [--------[ONS]-------------------------------------------------------------------(L)-----|
  642         12          01         552                                                                   602
[210]                   [2:74]
B3/602 - ] [ - File #3 CRYO_REGEN -  189
               File #6 TECH_RUNGS -  17
         ]/[ - File #3 CRYO_REGEN -  164
        -(L)- - File #3 CRYO_REGEN -  175
        -(U)- - File #3 CRYO_REGEN -  176
Rung #176
              ROR WAIT
              COMPRESSOR
  ROUGHING    2   60 SEC                                                                                 COMPRESSOR 2
  AND ROR 2   DONE                                                                                       ROR LATCH
  R&ROR2      C2RORTMR                                                                                   CY2RORL
    B3          T4:32                                                                                      B3
|---] [---------] [-------+-------------------------------------------------------------------------------(U)-----|
    642          DN       |                                                                                602
  [210]        [189]      |
                          | B3/602 - ] [ - File #3 CRYO_REGEN - 189
                          |                File #6 TECH_RUNGS - 17
  COMPRESSOR              |          ]/[ - File #3 CRYO_REGEN - 164
  2 REGEN-                |         -(L)- - File #3 CRYO_REGEN - 175
  ERATION                 |
  PROGRAM                 |
  CYRGN2                  |
    B3                    |
|---]/[-------------------+
    322
  [238]
```

```
Rung #177
|            CRYO 3                    CRYO 3                                              |
|ROUGHING    THERMCOUPL   BLOWER 2     ROR LATCH                              COMPRESSOR 3 |
|AND ROR 3   50 MICRON    ENABLED      ONE SHOT                               ROR LATCH    |
|R&ROR3      PIR5         BL2          C3RORLOS                               CY3RORL      |
|   B3          I:004        O:027        B3                                       B3      |
|---] [----------] [--------] [---------[ONS]-------------------------------------(L)-----|
|   643           13           01         553                                      603     |
|[211]                     [2:74]
B3/603 - ] [ - File #3 CRYO_REGEN -  190
               File #6 TECH_RUNGS -  17
         ]/[ - File #3 CRYO_REGEN -  165
         -(L)- - File #3 CRYO_REGEN -  177
         -(U)- - File #3 CRYO_REGEN -  178
Rung #178
|              ROR WAIT                                                                    |
|              COMPRESSOR                                                                  |
|  ROUGHING    3   60 SEC                                                     COMPRESSOR 3 |
|  AND ROR 3   DONE                                                           ROR LATCH    |
|  R&ROR3      C3RORTMR                                                       CY3RORL      |
|     B3          T4:33                                                             B3     |
|-+---] [---------] [----+------------------------------------------------------(U)-------|
| |   643           DN   |                                                          603    |
| |[211]         [190]   |                                                                 |
| |                      | B3/603 - ] [ - File #3 CRYO_REGEN - 190                         |
| |                      |                File #6 TECH_RUNGS - 17                          |
| |COMPRESSOR            |          ]/[ - File #3 CRYO_REGEN - 165                         |
| |3 REGEN-              |          -(L)- - File #3 CRYO_REGEN - 177                       |
| |ERATION               |                                                                 |
| |PROGRAM               |                                                                 |
| |CYRGN3                |                                                                 |
| |   B3                 |                                                                 |
| +---]/[----------------+                                                                 |
|     323                                                                                  |
|  [239]                                                                                   |
Rung #179
|            CRYO 5                    CRYO 4                                              |
|ROUGHING    THERMCOUPL   BLOWER 2     ROR LATCH                              COMPRESSOR 4 |
|AND ROR 4   50 MICRON    ENABLED      ONE SHOT                               ROR LATCH    |
|R&ROR4      PIR8         BL2          C4RORLOS                               CY4RORL      |
|   B3          I:024        O:027        B3                                       B3      |
|---] [----------] [--------] [---------[ONS]-------------------------------------(L)-----|
|   644           11           01         554                                      604     |
|[212]                     [2:74]
B3/604 - ] [ - File #3 CRYO_REGEN -  191
               File #6 TECH_RUNGS -  17
         ]/[ - File #3 CRYO_REGEN -  166
         -(L)- - File #3 CRYO_REGEN -  179
         -(U)- - File #3 CRYO_REGEN -  180
```

```
Rung #180
|                ROR WAIT                                                                                  |
|                COMPRESSOR                                                                                |
| ROUGHING       4    60 SEC                                                                COMPRESSOR 4  |
| AND ROR 4      DONE                                                                      ROR LATCH     |
| R&ROR4         C4RORTMR                                                                  CY4RORL       |
|    B3             T4:34                                                                       B3        |
|----] [-----------] [---+-----------------------------------------------------------------------(U)------|
| |  644              DN  |                                                                      604       |
| |[212]          [191]   |                                                                                |
| |                       | B3/604 - ] [ - File #3 CRYO_REGEN - 191                                        |
| |                       |              File #6 TECH_RUNGS - 17                                           |
| |COMPRESSOR             |        ]/[ - File #3 CRYO_REGEN - 166                                          |
| |4 REGEN-               |        -(L)- - File #3 CRYO_REGEN - 179                                        |
| |ERATION                |                                                                                |
| |PROGRAM                |                                                                                |
| |CYRGN4                 |                                                                                |
| |   B3                  |                                                                                |
| +---]/[-----------------+                                                                                |
|    324                                                                                                   |
| [240]                                                                                                    |
Rung #181
|         CRYO 4       CRYO 6       CRYO 7                    CRYO 5                                       |
|ROUGHING THERMCOUPL   THERMCOUPL   THERMCOUPL   BLOWER 2     ROR LATCH                   COMPRESSOR 5    |
|AND ROR 5 50 MICRON   50 MICRON    50 MICRON    ENABLED      ONE SHOT                    ROR LATCH       |
|R&ROR5   PIR7         PIR9         PIR12        BL2          C5RORLOS                    CY5RORL         |
|   B3       I:024        I:024        I:040       O:027         B3                           B3          |
|---] [-------] [----------] [----------] [---------] [--------[ONS]------------------------(L)-----------|
|  645         10           12           10          01          555                          605         |
|[213]                                            [2:74]                                                   |
B3/605 - ] [ - File #3 CRYO_REGEN -  192
               File #6 TECH_RUNGS -  17
         ]/[ - File #3 CRYO_REGEN -  167,168,169
         -(L)- - File #3 CRYO_REGEN -  181
         -(U)- - File #3 CRYO_REGEN -  182
Rung #182
|                ROR WAIT                                                                                  |
|                COMPRESSOR                                                                                |
| ROUGHING       5    60 SEC                                                                COMPRESSOR 5  |
| AND ROR 5      DONE                                                                      ROR LATCH     |
| R&ROR5         C5RORTMR                                                                  CY5RORL       |
|    B3             T4:35                                                                       B3        |
|----] [-----------] [---+-----------------------------------------------------------------------(U)------|
| |  645              DN  |                                                                      605       |
| |[213]          [192]   |                                                                                |
| |                       | B3/605 - ] [ - File #3 CRYO_REGEN - 192                                        |
| |                       |              File #6 TECH_RUNGS - 17                                           |
| |COMPRESSOR             |        ]/[ - File #3 CRYO_REGEN - 167, 168, 169                                |
| |5 REGEN-               |        -(L)- - File #3 CRYO_REGEN - 181                                        |
| |ERATION                |                                                                                |
| |PROGRAM                |                                                                                |
| |CYRGN5                 |                                                                                |
| |   B3                  |                                                                                |
| +---]/[-----------------+                                                                                |
|    325                                                                                                   |
| [241]                                                                                                    |
```

Rung #183

```
|         CRYO 8                 CRYO 6
|ROUGHING THERMCOUPL BLOWER 2  ROR LATCH                       COMPRESSOR 6 |
|AND ROR 6 50 MICRON ENABLED   ONE SHOT                        ROR LATCH    |
|R&ROR6   PIR13      BL2       C6RORLOS                        CY6RORL      |
|  B3      I:040     O:027     B3                                 B3        |
|---] [-----] [-------] [------[ONS]-------------------------------(L)------|
|  646      11        01       556                                606       |
|[214]              [2:74]
B3/606 - -] [- - File #3 CRYO_REGEN - 193
                 File #6 TECH_RUNGS - 17
         -]/[- - File #3 CRYO_REGEN - 170
         -(L)- - File #3 CRYO_REGEN - 183
         -(U)- - File #3 CRYO_REGEN - 184
```

Rung #184

```
|             ROR WAIT                                                      |
|             COMPRESSOR                                                    |
|  ROUGHING   6   60 SEC                                      COMPRESSOR 6 |
|  AND ROR 6  DONE                                            ROR LATCH    |
|  R&ROR6     C6RORTMR                                        CY6RORL      |
|     B3        T4:36                                             B3       |
|-+---] [--------] [------+-----------------------------------------(U)----|
| |   646         DN      |                                        606     |
| | [214]       [193]     |
| |                       | B3/606 - -] [- - File #3 CRYO_REGEN - 193
| |                       |                  File #6 TECH_RUNGS - 17
| |COMPRESSOR             |          -]/[- - File #3 CRYO_REGEN - 170
|  6 REGEN-               |          -(L)- - File #3 CRYO_REGEN - 183
| |ERATION                |
| |PROGRAM                |
| |CYRGN6                 |
| |     B3                |
| +----]/[----------------+
|      326
|  [242]
```

Rung #185

```
|        CRYO 10    CRYO 9     CRYO 12               CRYO 7
|ROUGHING THERMCOUPL THERMCOUPL THERMCOUPL BLOWER 2  ROR LATCH           COMPRESSOR 7 |
|AND ROR 7 50 MICRON 50 MICRON 50 MICRON ENABLED   ONE SHOT            ROR LATCH    |
|R&ROR7   PIR18     PIR14      PIR20      BL2      C7RORLOS            CY7RORL      |
|  B3      I:054     I:040     I:054      O:027     B3                    B3        |
|---] [-----] [-------] [--------] [--------] [-----[ONS]-----------------(L)-------|
|  647      11        12         13         01     557                   607        |
|[215]                                    [2:74]
B3/607 - -] [- - File #3 CRYO_REGEN - 194
                 File #6 TECH_RUNGS - 17
         -]/[- - File #3 CRYO_REGEN - 171,172,173
         -(L)- - File #3 CRYO_REGEN - 185
         -(U)- - File #3 CRYO_REGEN - 186
```

Rung #186

```
|           ROR WAIT                                                         |
|           COMPRESSOR                                                       |
| ROUGHING  7   60 SEC                                          COMPRESSOR 7 |
| AND ROR 7 DONE                                                ROR LATCH    |
| R&ROR7    C7RORTMR                                            CY7RORL      |
|    B3       T4:37                                                  B3      |
|----] [-------] [---+----------------------------------------------(U)-----|
| |  647        DN   |                                                607     |
| |[215]      [194]  |                                                        |
| |                  | B3/607 - ] [ - File #3 CRYO_REGEN - 194                |
| |                  |               File #6 TECH_RUNGS - 17                  |
| |COMPRESSOR        |          ]/[ - File #3 CRYO_REGEN - 171, 172, 173      |
| |7 REGEN-          |          -(L)- - File #3 CRYO_REGEN - 185              |
| |ERATION           |                                                        |
| |PROGRAM           |                                                        |
| |CYRGN7            |                                                        |
| |    B3            |                                                        |
| +---]/[------------+                                                        |
|    327                                                                      |
|  [243]                                                                      |
```

Rung #187

```
|          CRYO 11               CRYO 8                                       |
|ROUGHING  THERMCOUPL  BLOWER 2  ROR LATCH                     COMPRESSOR 8 |
|AND ROR 8 50 MICRON   ENABLED   ONE SHOT                      ROR LATCH    |
|R&ROR8    PIR19       BL2       C8RORLOS                      CY8RORL      |
   B3        I:054     O:027       B3                                B3     |
---] [--------] [--------] [-------[ONS]-----------------------------(L)----|
|  648         12        01        558                               608    |
|[216]                 [2:74]                                               |
B3/608 - ] [ - File #3 CRYO_REGEN - 195
               File #6 TECH_RUNGS - 17
         ]/[ - File #3 CRYO_REGEN - 174
        -(L)- - File #3 CRYO_REGEN - 187
        -(U)- - File #3 CRYO_REGEN - 188
```

Rung #188

```
|           ROR WAIT                                                         |
|           COMPRESSOR                                                       |
| ROUGHING  8   60 SEC                                          COMPRESSOR 8 |
| AND ROR 8 DONE                                                ROR LATCH    |
| R&ROR8    C8RORTMR                                            CY8RORL      |
|    B3       T4:38                                                  B3      |
|----] [-------] [---+----------------------------------------------(U)-----|
| |  648        DN   |                                                608     |
| |[216]      [195]  |                                                        |
| |                  | B3/608 - ] [ - File #3 CRYO_REGEN - 195                |
| |                  |               File #6 TECH_RUNGS - 17                  |
| |COMPRESSOR        |          ]/[ - File #3 CRYO_REGEN - 174                |
| |8 REGEN-          |          -(L)- - File #3 CRYO_REGEN - 187              |
|  ERATION           |                                                        |
| |PROGRAM           |                                                        |
| |CYRGN8            |                                                        |
| |    B3            |                                                        |
| +---]/[------------+                                                        |
|    328                                                                      |
|  [244]                                                                      |
```

```
Rung #189
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 2                                             COMPRESSOR              |
|AND ROR 2  ROR LATCH                                                2   60 SEC              |
|R&ROR2     CY2RORL                                                  C2RORTMR                |
|   B3            B3                                                 +-TON--------------+    |
|---] [-----------] [------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   642           602                                                |TIMER:       T4:32|    |
|[210]       [176]                                                   |BASE (SEC):    1.0|-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +------------------+    |
T4:32.DN - ] [ - File #3 CRYO_REGEN -  176,196,203
T4:32.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #190
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 3                                             COMPRESSOR              |
|AND ROR 3  ROR LATCH                                                3   60 SEC              |
|R&ROR3     CY3RORL                                                  C3RORTMR                |
|   B3            B3                                                 +-TON--------------+    |
|---] [-----------] [------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   643           603                                                |TIMER:       T4:33|    |
|[211]       [178]                                                   |BASE (SEC):    1.0|-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +------------------+    |
T4:33.DN - ] [ - File #3 CRYO_REGEN -  178,197,204
T4:33.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #191
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 4                                             COMPRESSOR              |
|AND ROR 4  ROR LATCH                                                4   60 SEC              |
|R&ROR4     CY4RORL                                                  C4RORTMR                |
|   B3            B3                                                 +-TON--------------+    |
|---] [-----------] [------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   644           604                                                |TIMER:       T4:34|    |
|[212]       [180]                                                   |BASE (SEC):    1.0|-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +------------------+    |
T4:34.DN - ] [ - File #3 CRYO_REGEN -  180,198,205
T4:34.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #192
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 5                                             COMPRESSOR              |
|AND ROR 5  ROR LATCH                                                5   60 SEC              |
|R&ROR5     CY5RORL                                                  C5RORTMR                |
|   B3            B3                                                 +-TON--------------+    |
|---] [-----------] [------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   645           605                                                |TIMER:       T4:35|    |
|[213]       [182]                                                   |BASE (SEC):    1.0|-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +------------------+    |
T4:35.DN - ] [ - File #3 CRYO_REGEN -  182,199,206
T4:35.TT - ] [ - File #6 TECH_RUNGS -  18
```

```
Rung #193
|                                                              ROR WAIT               |
|ROUGHING   COMPRESSOR 6                                       COMPRESSOR             |
|AND ROR 6  ROR LATCH                                          6   60 SEC             |
|R&ROR6     CY6RORL                                            C6RORTMR               |
|   B3          B3                                             +-TON-------------+    |
|---] [---------] [--------------------------------------------+TIMER ON DELAY   +-(EN)-|
|  646         606                                             |TIMER:      T4:36|    |
|[214]       [184]                                             |BASE (SEC):   1.0+-(DN) |
|                                                              |PRESET:        30|    |
|                                                              |ACCUM:          0|    |
|                                                              +-----------------+    |
T4:36.DN - ] [ - File #3 CRYO_REGEN -  184,200,207
T4:36.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #194
|                                                              ROR WAIT               |
|ROUGHING   COMPRESSOR 7                                       COMPRESSOR             |
|AND ROR 7  ROR LATCH                                          7   60 SEC             |
|R&ROR7     CY7RORL                                            C7RORTMR               |
|   B3          B3                                             +-TON-------------+    |
|---] [---------] [--------------------------------------------+TIMER ON DELAY   +-(EN)-|
|  647         607                                             |TIMER:      T4:37|    |
|[215]       [186]                                             |BASE (SEC):   1.0+-(DN) |
|                                                              |PRESET:        30|    |
|                                                              |ACCUM:          0|    |
|                                                              +-----------------+    |
T4:37.DN - ] [ - File #3 CRYO_REGEN -  186,201,208
T4:37.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #195
|                                                              ROR WAIT               |
|ROUGHING   COMPRESSOR 8                                       COMPRESSOR             |
|AND ROR 8  ROR LATCH                                          8   60 SEC             |
|R&ROR8     CY8RORL                                            C8RORTMR               |
|   B3          B3                                             +-TON-------------+    |
|---] [---------] [--------------------------------------------+TIMER ON DELAY   +-(EN)-|
|  648         608                                             |TIMER:      T4:38|    |
|[216]       [188]                                             |BASE (SEC):   1.0+-(DN) |
|                                                              |PRESET:        30|    |
|                                                              |ACCUM:          0|    |
|                                                              +-----------------+    |
T4:38.DN - ] [ - File #3 CRYO_REGEN -  188,202,209
T4:38.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #196
|           ROR WAIT                                           REROUGH                |
|           COMPRESSOR  CRYO 2                                 COUNTER                |
|ROUGHING   2   60 SEC  THERMCOUPL                             COMPRESSOR             |
|AND ROR 2  DONE        50 MICRON                              2                      |
|R&ROR2     C2RORTMR    PIR4                                   C2RERUF                |
|   B3        T4:32       I:004                                +-CTU-------------+    |
|---] [---------] [---------]/[--------------------------------+COUNT UP         +-(CU)-|
|  642         DN          12                                  |COUNTER:     C5:2|    |
|[210]       [189]                                             |PRESET:        10+-(DN) |
|                                                              |ACCUM:          0|    |
|                                                              +-----------------+    |
C5:2 - CTU - File #3 CRYO_REGEN -  196
       RES - File #3 CRYO_REGEN -  224
C5:2.DN - ] [ - File #2 MAIN_PRGRM -  623,623
```

```
Rung #197
|             ROR WAIT                                                                    REROUGH            |
|             COMPRESSOR  CRYO 3                                                          COUNTER            |
|ROUGHING     3   60 SEC  THERMCOUPL                                                      COMPRESSOR         |
|AND ROR 3    DONE        50 MICRON                                                       3                  |
|R&ROR3       C3RORTMR    PIR5                                                            C3RERUF            |
|  B3          T4:33        I:004                                                         ┌─CTU────────┐     |
|──┤ ├──────────┤ ├──────────┤/├──────────────────────────────────────────────────────────┤COUNT UP    ├─(CU)─|
|  643           DN          13                                                           │COUNTER: C5:3│    |
|[211]       [190]                                                                        │PRESET:    15├─(DN)|
|                                                                                         │ACCUM:      0│    |
|                                                                                         └────────────┘     |
C5:3 - CTU - File #3 CRYO_REGEN -  197
       RES - File #3 CRYO_REGEN -  225
C5:3.DN - ┤ ├ - File #2 MAIN_PRGRM -  623
Rung #198
|             ROR WAIT                                                                    REROUGH            |
|             COMPRESSOR  CRYO 5                                                          COUNTER            |
|ROUGHING     4   60 SEC  THERMCOUPL                                                      COMPRESSOR         |
|AND ROR 4    DONE        50 MICRON                                                       4                  |
|R&ROR4       C4RORTMR    PIR8                                                            C4RERUF            |
|  B3          T4:34        I:024                                                         ┌─CTU────────┐     |
|──┤ ├──────────┤ ├──────────┤/├──────────────────────────────────────────────────────────┤COUNT UP    ├─(CU)─|
|  644           DN          11                                                           │COUNTER: C5:4│    |
|[212]       [191]                                                                        │PRESET:    10├─(DN)|
|                                                                                         │ACCUM:      0│    |
|                                                                                         └────────────┘     |
 .4 - CTU - File #3 CRYO_REGEN -  198
       RES - File #3 CRYO_REGEN -  226
C5:4.DN - ┤ ├ - File #2 MAIN_PRGRM -  623
Rung #199
|             ROR WAIT                                                                    REROUGH            |
|             COMPRESSOR    CRYO 4                                                        COUNTER            |
|ROUGHING     5   60 SEC    THERMCOUPL                                                    COMPRESSOR         |
|AND ROR 5    DONE          50 MICRON                                                     5                  |
|R&ROR5       C5RORTMR      PIR7                                                          C5RERUF            |
|  B3          T4:35          I:024                                                       ┌─CTU────────┐     |
|──┤ ├──────────┤ ├─────┬──────┤/├──────┬─────────────────────────────────────────────────┤COUNT UP    ├─(CU)─|
|  645           DN     |       10      |                                                 │COUNTER: C5:5│    |
|[213]       [192]      |               |                                                 │PRESET:    10├─(DN)|
|                       |               | C5:5 - RES - File #3 CRYO_REGEN - 227           │ACCUM:      0│    |
|                       |CRYO 6         | C5:5.DN - ┤ ├ - File #2 MAIN_PRGRM - 623        └────────────┘     |
|                       |THERMCOUPL     |                                                                    |
|                       |50 MICRON      |                                                                    |
|                       |PIR9           |                                                                    |
|                       |     I:024     |                                                                    |
|                       ├──────┤/├──────┤                                                                    |
|                       |      12       |                                                                    |
|                       |CRYO 7         |                                                                    |
|                       |THERMCOUPL     |                                                                    |
|                       |50 MICRON      |                                                                    |
|                       |PIR12          |                                                                    |
|                       |     I:040     |                                                                    |
|                       └──────┤/├──────┘                                                                    |
|                             10                                                                             |
```

Rung #200

```
|            ROR WAIT                                                     REROUGH          |
|            COMPRESSOR  CRYO 8                                           COUNTER          |
|ROUGHING    6   60 SEC  THERMCOUPL                                       COMPRESSOR       |
|AND ROR 6   DONE        50 MICRON                                        6                |
|R&ROR6      C6RORTMR    PIR13                                            C6R3RUF          |
|   B3          T4:36      I:040                                          +-CTU----------+ |
|---] [---------] [---------]/[------------------------------------------|COUNT UP      |-(CU)-|
|   646          DN         11                                            |COUNTER:  C5:6| |
|[214]       [193]                                                        |PRESET:     10|-(DN) |
|                                                                         |ACCUM:       0| |
|                                                                         +--------------+ |
C5:6 - CTU - File #3 CRYO_REGEN -  200
       RES - File #3 CRYO_REGEN -  228
C5:6.DN - -] [- - File #2 MAIN_PRGRM -  623
```

Rung #201

```
|            ROR WAIT                                                     REROUGH          |
|            COMPRESSOR     CRYO 9                                        COUNTER          |
|ROUGHING    7   60 SEC     THERMCOUPL                                    COMPRESSOR       |
|AND ROR 7   DONE           50 MICRON                                     7                |
|R&ROR7      C7RORTMR       PIR14                                         C7RERUF          |
|   B3          T4:37         I:040                                       +-CTU----------+ |
|---] [---------] [--------+----]/[----+---------------------------------|COUNT UP      |-(CU)-|
|   647          DN        |     12    |                                  |COUNTER:  C5:7| |
|[215]       [194]         |           |                                  |PRESET:     10|-(DN) |
|                          |           | C5:7 - RES - File #3 CRYO_REGEN - 229  |ACCUM: 0| |
|                          |CRYO 10    | C5:7.DN - -] [- - File #2 MAIN_PRGRM - 623   +--+ |
|                          |THERMCOUPL |                                                    |
|                          |50 MICRON  |                                                    |
|                          |PIR18      |                                                    |
|                          |   I:054   |                                                    |
|                          +----]/[----+                                                    |
|                          |    11.    |                                                    |
|                          |CRYO 12    |                                                    |
|                          |THERMCOUPL |                                                    |
|                          |50 MICRON  |                                                    |
|                          |PIR20      |                                                    |
|                          |   I:054   |                                                    |
|                          +----]/[----+                                                    |
|                               13                                                          |
```

Rung #202

```
|            ROR WAIT                                                     REROUGH          |
|            COMPRESSOR  CRYO 11                                          COUNTER          |
|ROUGHING    8   60 SEC  THERMCOUPL                                       COMPRESSOR       |
|AND ROR 8   DONE        50 MICRON                                        8                |
|R&ROR8      C8RORTMR    PIR19                                            C8RERUF          |
|   B3          T4:38      I:054                                          +-CTU----------+ |
|---] [---------] [---------]/[------------------------------------------|COUNT UP      |-(CU)-|
|   648          DN         12                                            |COUNTER:  C5:8| |
 :16]        [195]                                                        |PRESET:     10|-(DN) |
|                                                                         |ACCUM:       0| |
|                                                                         +--------------+ |
C5:8 - CTU - File #3 CRYO_REGEN -  202
       RES - File #3 CRYO_REGEN -  230
C5:8.DN - -] [- - File #2 MAIN_PRGRM -  623
```

```
Rung #203
|
|                      ROR WAIT
|           CRYO 2     COMPRESSOR  CRYO 2                                         COOL DOWN |
|ROUGHING   THERMCOUPL 2   60 SEC  TEMPERATUR                                     2         |
|AND ROR 2  50 MICRON  DONE        =<20K                                          CD2       |
|R&ROR2     PIR4       C2RORTMR    CY2TMP20                                                 |
|   B3        I:004      T4:32       B3                                            B3       |
|---] [-------] [--------] [--------]/[-------------------------------------------(L)------|
|   642        12         DN        502                                            652      |
|[210]                 [189]
B3/652 - ] [ - - File #2 MAIN_PRGRM -  27,117,118
                 File #3 CRYO_REGEN -  164,210,217,238
                 File #6 TECH_RUNGS -  19
        -(L)- -  File #3 CRYO_REGEN -  203
        -(U)- -  File #3 CRYO_REGEN -  231
Rung #204
|
|                      ROR WAIT
|           CRYO 3     COMPRESSOR  CRYO 3                                         COOL DOWN |
|ROUGHING   THERMCOUPL 3   60 SEC  TEMPERATUR                                     3         |
|AND ROR 3  50 MICRON  DONE        =<20K                                          CD3       |
|R&ROR3     PIR5       C3RORTMR    CY3TMP20                                                 |
|   B3        I:004      T4:33       B3                                            B3       |
|---] [-------] [--------] [--------]/[-------------------------------------------(L)------|
|   643        13         DN        503                                            653      |
|[211]                 [190]
B3/653 - ] [ - - File #2 MAIN_PRGRM -  28,119,120
                 File #3 CRYO_REGEN -  165,211,218,239
                 File #6 TECH_RUNGS -  19
        -(L)- -  File #3 CRYO_REGEN -  204
        -(U)- -  File #3 CRYO_REGEN -  232
Rung #205
|
|                      ROR WAIT
|           CRYO 5     COMPRESSOR  CRYO 5                                         COOL DOWN |
|ROUGHING   THERMCOUPL 4   60 SEC  TEMPERATUR                                     4         |
|AND ROR 4  50 MICRON  DONE        =<20K                                          CD4       |
|R&ROR4     PIR8       C4RORTMR    CY5TMP20                                                 |
|   B3        I:024      T4:34       B3                                            B3       |
|---] [-------] [--------] [--------]/[-------------------------------------------(L)------|
|   644        11         DN        505                                            654      |
|[212]                 [191]
B3/654 - ] [ - - File #2 MAIN_PRGRM -  29,123,124
                 File #3 CRYO_REGEN -  166,212,219,240
                 File #6 TECH_RUNGS -  19
        -(L)- -  File #3 CRYO_REGEN -  205
        -(U)- -  File #3 CRYO_REGEN -  233
```

Rung #206

```
|                                                    ROR WAIT
|          CRYO 4       CRYO 6       CRYO 7       COMPRESSOR     CRYO 4
|ROUGHING  THERMCOUPL   THERMCOUPL   THERMCOUPL   5    60 SEC    TEMPERATUR                                      COOL DOWN
|AND ROR 5 50 MICRON    50 MICRON    50 MICRON    DONE           =<20K                                           5
|R&ROR5    PIR7         PIR9         PIR12        C5RORTMR       CY4TMP20                                        CD5
|   B3        I:024        I:024        I:040        T4:35          B3                                            B3
|---] [--------] [--------] [--------] [--------] [------+------]/[----+-----------------------------------------(L)---
|  645          10          12           10           DN  |     504   |                                          655
|[213]                                              [192] |           |
|                                                         |           | B3/655 - ] [ - - File #2 MAIN_PRGRM - 30, 121, 122,
|                                                         |CRYO 6     |                   125, 126, 127, 128
|                                                         |TEMPERATUR |                   File #3 CRYO_REGEN - 167, 168, 169,
|                                                         |=<20K      |                   213, 220, 241
|                                                         |CY6TMP20   |                   File #6 TECH_RUNGS - 19
|                                                         |    B3     |         -(U)- - File #3 CRYO_REGEN - 234
|                                                         +----]/[----+
|                                                         |   506     |
|                                                         |CRYO 7     |
|                                                         |TEMPERATUR |
|                                                         |=<20K      |
|                                                         |CY7TMP20   |
|                                                         |    B3     |
|                                                         +----]/[----+
|                                                             507
```

Rung #207

```
                        ROR WAIT
           CRYO 8       COMPRESSOR   CRYO 8
|ROUGHING  THERMCOUPL   6    60 SEC  TEMPERATUR                                                     COOL DOWN
|AND ROR 6 50 MICRON    DONE         =<20K                                                          6
|R&ROR6    PIR13        C6RORTMR     CY8TMP20                                                       CD6
|   B3        I:040       T4:36         B3                                                           B3
|---] [--------] [--------] [-----------]/[-----------------------------------------------------------(L)---
|  646          11          DN          508                                                          656
|[214]                    [193]
B3/656 - ] [ - - File #2 MAIN_PRGRM -  31,129,130
                 File #3 CRYO_REGEN -  170,214,221,242
                 File #6 TECH_RUNGS -  19
       -(L)- - File #3 CRYO_REGEN -  207
       -(U)- - File #3 CRYO_REGEN -  235
```

Rung #208

ROUGHING AND ROR 7 R&ROR7 B3 647 [215]

CRYO 9 THERMCOUPL 50 MICRON PIR14 I:040 12

CRYO 10 THERMCOUPL 50 MICRON PIR18 I:054 11

CRYO 12 THERMCOUPL 50 MICRON PIR20 I:054 13

ROR WAIT COMPRESSOR 7 60 SEC DONE C7RORTMR T4:37 DN [194]

CRYO 9 TEMPERATUR =<20K CY9TMP20 B3 509

CRYO 10 TEMPERATUR =<20K CY10TMP20 B3 510

CRYO 12 TEMPERATUR =<20K CY12TMP20 B3 512

COOL DOWN 7 CD7 B3 -(L)- 657

B3/657 - ┤ ├ - File #2 MAIN_PRGRM - 32, 131, 132, 133, 134, 137, 138
File #3 CRYO_REGEN - 171, 172, 173, 215, 222, 243
File #6 TECH_RUNGS - 19
-(U)- - File #3 CRYO_REGEN - 236

Rung #209

ROUGHING AND ROR 8 R&ROR8 B3 648 [216]

CRYO 11 THERMCOUPL 50 MICRON PIR19 I:054 12

ROR WAIT COMPRESSOR 8 60 SEC DONE C8RORTMR T4:38 DN [195]

CRYO 11 TEMPERATUR =<20K CY11TMP20 B3 511

COOL DOWN 8 CD8 B3 -(L)- 658

B3/658 - ┤ ├ - File #2 MAIN_PRGRM - 33,135,136
File #3 CRYO_REGEN - 174,216,223,244
File #6 TECH_RUNGS - 19
-(L)- - File #3 CRYO_REGEN - 209
-(U)- - File #3 CRYO_REGEN - 237

Rung #210

COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2 B3 322 [238]

PDM2 T4:42 TT [217]

COOL DOWN 2 CD2 B3 652 [203]

COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2 B3 322 [238]

ROUGHING AND ROR 2 R&ROR2 B3 -(U)- 642

B3/642 - ┤ ├ - File #3 CRYO_REGEN - 135, 164, 175, 176, 189, 196, 203
File #6 TECH_RUNGS - 17
-(L)- - File #3 CRYO_REGEN - 128

Rung #211

```
| COMPRESSOR                                                                     |
| 3 REGEN-                                                                       |
| ERATION          COOL DOWN                                            ROUGHING |
| PROGRAM          3                                                    AND ROR 3|
| CYRGN3     PDM3  CD3                                                  R&ROR3   |
|      B3    T4:43    B3                                                   B3    |
|-+----] [------] [-----] [--+----------------------------------------------(U)---|
| |    323      TT     653   |                                             643   |
| |[239]     [218]  [204]    |                                                   |
| |                          | B3/643 - ] [ - File #3 CRYO_REGEN - 136, 165, 177, 178, 190, 197, 204
| |                          |              File #6 TECH_RUNGS - 17              |
| |COMPRESSOR                |         -(L)- - File #3 CRYO_REGEN - 129          |
| |3 REGEN-                  |                                                   |
| |ERATION                   |                                                   |
| |PROGRAM                   |                                                   |
| |CYRGN3                    |                                                   |
| |    B3                    |                                                   |
| +----]/[-------------------+                                                   |
|      323                                                                       |
| [239]                                                                          |
```

Rung #212

```
| COMPRESSOR                                                                     |
| 4 REGEN-                                                                       |
| ERATION          COOL DOWN                                            ROUGHING |
| PROGRAM          4                                                    AND ROR 4|
| CYRGN4     PDM4  CD4                                                  R&ROR4   |
|      B3    T4:44    B3                                                   B3    |
|-+----] [------] [-----] [--+----------------------------------------------(U)---|
| |    324      TT     654   |                                             644   |
| |[240]     [219]  [205]    |                                                   |
| |                          | B3/644 - ] [ - File #3 CRYO_REGEN - 137, 166, 179, 180, 191, 198, 205
| |                          |              File #6 TECH_RUNGS - 17              |
| |COMPRESSOR                |         -(L)- - File #3 CRYO_REGEN - 130          |
| |4 REGEN-                  |                                                   |
| |ERATION                   |                                                   |
| |PROGRAM                   |                                                   |
| |CYRGN4                    |                                                   |
| |    B3                    |                                                   |
| +----]/[-------------------+                                                   |
|      324                                                                       |
| [240]                                                                          |
```

Rung #213

```
| COMPRESSOR                                                                     |
| 5 REGEN-                                                                       |
| ERATION          COOL DOWN                                            ROUGHING |
| PROGRAM          5                                                    AND ROR 5|
| CYRGN5     PDM5  CD5                                                  R&ROR5   |
|      B3    T4:45    B3                                                   B3    |
|-+----] [------] [-----] [--+----------------------------------------------(U)---|
| |    325      TT     655   |                                             645   |
| |[241]     [220]  [206]    |                                                   |
| |                          | B3/645 - ] [ - File #3 CRYO_REGEN - 138, 167, 168, 169, 181, 182, 192, 199, 206
| |                          |              File #6 TECH_RUNGS - 17              |
| |COMPRESSOR                |         -(L)- - File #3 CRYO_REGEN - 131          |
| |5 REGEN-                  |                                                   |
| |ERATION                   |                                                   |
| |PROGRAM                   |                                                   |
| |CYRGN5                    |                                                   |
| |    B3                    |                                                   |
| +----]/[-------------------+                                                   |
|      325                                                                       |
| [241]                                                                          |
```

```
Rung #214
 COMPRESSOR
 6 REGEN-                                                          ROUGHING
 ERATION              COOL DOWN                                    AND ROR 6
 PROGRAM              6                                            R&ROR6
 CYRGN6      PDM6     CD6                                          B3
    B3       T4:46    B3
---] [-------] [------] [----------------------------------------------(U)---
    326       TT      656                                          646
 [242]      [221]   [207]      B3/646 - ] [ - File #3 CRYO_REGEN - 139, 170, 183, 184, 193, 200, 207
                                            File #6 TECH_RUNGS - 17
 COMPRESSOR                           -(L)- - File #3 CRYO_REGEN - 132
 6 REGEN-
 ERATION
 PROGRAM
 CYRGN6
    B3
---]/[---
    326
 [242]

Rung #215
 COMPRESSOR
 7 REGEN-                                                          ROUGHING
 ERATION              COOL DOWN                                    AND ROR 7
 PROGRAM              7                                            R&ROR7
 CYRGN7      PDM7     CD7                                          B3
    B3       T4:47    B3
---] [-------] [------] [----------------------------------------------(U)---
    327       TT      657                                          647
 [243]      [222]   [208]      B3/647 - ] [ - File #3 CRYO_REGEN - 140, 171, 172, 173, 185, 186, 194, 201, 208
                                            File #6 TECH_RUNGS - 17
 COMPRESSOR                           -(L)- - File #3 CRYO_REGEN - 133
 7 REGEN-
 ERATION
 PROGRAM
 CYRGN7
    B3
---]/[---
    327
 [243]

Rung #216
 COMPRESSOR
 8 REGEN-                                                          ROUGHING
 ERATION              COOL DOWN                                    AND ROR 8
 PROGRAM              8                                            R&ROR8
 CYRGN8      PDM8     CD8                                          B3
    B3       T4:48    B3
---] [-------] [------] [----------------------------------------------(U)---
    328       TT      658                                          648
 [244]      [223]   [209]      B3/648 - ] [ - File #3 CRYO_REGEN - 141, 174, 187, 188, 195, 202, 209
                                            File #6 TECH_RUNGS - 17
 COMPRESSOR                           -(L)- - File #3 CRYO_REGEN - 134
 8 REGEN-
 ERATION
 PROGRAM
 CYRGN8
    B3
---]/[---
    328
 [244]
```

545

Rung #217

```
|           CRYO 2                                        REGEN
|COOL DOWN TEMPERATUR                                     TIME TO
|2          =<20K                                         20K  2
|CD2        CY2TMP20                                      PDM2
|  B3         B3                                          +-TON-----------------+
+--] [--------]/[-----------------------------------------+TIMER ON DELAY       +-(EN)-
|  652        502                                         |TIMER:        T4:42  |
|[203]                                                    |BASE (SEC):     1.0  +-(DN)
|                                                         |PRESET:        7200  |
|                                                         |ACCUM:            0  |
|                                                         +---------------------+
T4:42.DN - ] [ - File #3 CRYO_REGEN - 32,252
T4:42.TT - ] [ - File #3 CRYO_REGEN - 210
```

Rung #218

```
|           CRYO 3                                        REGEN
|COOL DOWN TEMPERATUR                                     TIME TO
|3          =<20K                                         20K  3
|CD3        CY3TMP20                                      PDM3
|  B3         B3                                          +-TON-----------------+
+--] [--------]/[-----------------------------------------+TIMER ON DELAY       +-(EN)-
|  653        503                                         |TIMER:        T4:43  |
|[204]                                                    |BASE (SEC):     1.0  +-(DN)
|                                                         |PRESET:        7200  |
|                                                         |ACCUM:            0  |
|                                                         +---------------------+
T4:43.DN - ] [ - File #3 CRYO_REGEN - 32,253
T4:43.TT - ] [ - File #3 CRYO_REGEN - 211
```

Rung #219

```
|           CRYO 5                                        REGEN
|COOL DOWN TEMPERATUR                                     TIME TO
|4          =<20K                                         20K  4
|CD4        CY5TMP20                                      PDM4
|  B3         B3                                          +-TON-----------------+
+--] [--------]/[-----------------------------------------+TIMER ON DELAY       +-(EN)-
|  654        505                                         |TIMER:        T4:44  |
|[205]                                                    |BASE (SEC):     1.0  +-(DN)
|                                                         |PRESET:        7200  |
|                                                         |ACCUM:            0  |
|                                                         +---------------------+
T4:44.DN - ] [ - File #3 CRYO_REGEN - 32,254
T4:44.TT - ] [ - File #3 CRYO_REGEN - 212
```

```
Rung #220
|                                                                  REGEN
|COOL DOWN  CRYO 4                                                 TIME TO
|5          TEMPERATUR                                             20K  5
|CD5        =<20K                                                  PDM5
|           CY4TMP20                                               +-TON-----------------+
|   B3         B3                                                 -|TIMER ON DELAY       |-(EN)-
|---| |----+---|/|---+--------------------------------------------|TIMER:          T4:45|
|   655    |   504   |                                             |BASE (SEC):      1.0|-(DN)
|[206]     |         | T4:45.DN - -| |- - File #3 CRYO_REGEN - 32, 255  |PRESET:         7200|
|          |         | T4:45.TT - -| |- - File #3 CRYO_REGEN - 213      |ACCUM:             0|
|          |CRYO 6   |                                                 +---------------------+
|          |TEMPERATUR
|          |=<20K    |
|          |CY6TMP20 |
|          |   B3    |
|          +---|/|---+
|          |   506   |
|          |CRYO 7   |
|          |TEMPERATUR
|          |=<20K    |
|          |CY7TMP20 |
|          |   B3    |
|          +---|/|---+
|              507
Rung #221
|                                                                  REGEN
|COOL DOWN  CRYO 8                                                 TIME TO
|6          TEMPERATUR                                             20K  6
|           =<20K                                                  PDM6
|CD6        CY8TMP20                                               +-TON-----------------+
|   B3         B3                                                 -|TIMER ON DELAY       |-(EN)-
|---| |--------|/|------------------------------------------------|TIMER:          T4:46|
|   656        508                                                 |BASE (SEC):      1.0|-(DN)
|[207]                                                             |PRESET:         7200|
|                                                                  |ACCUM:             0|
|                                                                  +---------------------+
T4:46.DN - -| |- - File #3 CRYO_REGEN -  32,256
T4:46.TT - -| |- - File #3 CRYO_REGEN -  214
Rung #222
|                                                                  REGEN
|COOL DOWN  CRYO 9                                                 TIME TO
|7          TEMPERATUR                                             20K  7
|CD7        =<20K                                                  PDM7
|           CY9TMP20                                               +-TON-----------------+
|   B3         B3                                                 -|TIMER ON DELAY       |-(EN)-
|---| |----+---|/|---+--------------------------------------------|TIMER:          T4:47|
|   657    |   509   |                                             |BASE (SEC):      1.0|-(DN)
|[208]     |         | T4:47.DN - -| |- - File #3 CRYO_REGEN - 32, 257  |PRESET:         7200|
|          |         | T4:47.TT - -| |- - File #3 CRYO_REGEN - 215      |ACCUM:             0|
|          |CRYO 10  |                                                 +---------------------+
|          |TEMPERATUR
|          |=<20K    |
|          |CY10TMP20|
|          |   B3    |
|          +---|/|---+
|          |   510   |
|          |CRYO 12  |
|          |TEMPERATUR
|          |=<20K    |
|          |CY12TMP20|
|          |   B3    |
|          +---|/|---+
|              512
```

```
Rung #223
|          CRYO 11                                                              REGEN            |
|COOL DOWN TEMPERATUR                                                           TIME TO          |
|8         =<20K                                                                20K  8           |
|CD8       CY11TMP20                                                            PDM8             |
|   B3        B3                                                                +-TON-----------+ |
|---| |-------|/|---------------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|  658       511                                                                |TIMER:    T4:48| |
|[209]                                                                          |BASE (SEC): 1.0|-(DN) |
|                                                                               |PRESET:    7200| |
|                                                                               |ACCUM:        0| |
|                                                                               +---------------+ |
T4:48.DN - -| |- - File #3 CRYO_REGEN -  32,258
T4:48.TT - -| |- - File #3 CRYO_REGEN -  216


BASE :   Rung #224
| COMPRESSOR  CRYO 2                                                            REROUGH          |
| 2 REGEN-    COUNTER                                                           COUNTER          |
| ERATION     RESET                                                             COMPRESSOR       |
| PROGRAM     ONE SHOT                                                          2                |
| CYRGN2      C2CROS                                                            C2RERUF          |
|      B3        B3                                                                C5:2          |
|-+-----|/|------[ONS]-+--------------------------------------------------------------(RES)--------|
| |    322        562  |                                                                         |
| [238]                |                                                                         |
|                      | C5:2 - CTU - File #3 CRYO_REGEN - 196                                   |
| |                    | C5:2.DN - -| |- - File #2 MAIN_PRGRM - 624                               |
| |PAUSE               |                                                                         |
| |DISABLE             |                                                                         |
| |TS12                |                                                                         |
| |  N7:16             |                                                                         |
| +---| |--------------+                                                                         |
|      4                                                                                         |
|  [2:3]                                                                                         |
```

BASE : Rung #225

```
| COMPRESSOR  CRYO 3                                          REROUGH    |
| 3 REGEN-    COUNTER                                         COUNTER    |
| ERATION     RESET                                           COMPRESSOR |
| PROGRAM     ONE SHOT                                        3          |
| CYRGN3      C3CROS                                          C3RERUF    |
|       B3        B3                                              C5:3   |
|-+----|/|------[ONS]-+-----------------------------------------[RES]----|
| |    323       563  |                                                  |
| |[239]              |                                                  |
| |                   | C5:3 - CTU - File #3 CRYO_REGEN - 197            |
| |                   | C5:3.DN - -| |- - File #2 MAIN_PRGRM - 624       |
| |PAUSE              |                                                  |
| |DISABLE            |                                                  |
| |TS12               |                                                  |
| |  N7:16            |                                                  |
| +----| |------------+                                                  |
|       4                                                                |
|  [2:3]
```

```
BASE :   Rung #226
| COMPRESSOR  CRYO 4                                                      REROUGH     |
| 4 REGEN-    COUNTER                                                     COUNTER     |
| ERATION     RESET                                                       COMPRESSOR  |
| PROGRAM     ONE SHOT                                                    4.          |
| CYRGN4      C4CROS                                                      C4RERUF     |
|       B3          B3                                                       C5:4     |
|-+----]/[--------[ONS]--+---------------------------------------------------[RES]----|
| |      324         564  |                                                           |
| |[240]                  |                                                           |
| |                       | C5:4 - CTU - File #3 CRYO_REGEN - 198                     |
| |                       | C5:4.DN - ] [ - File #2 MAIN_PRGRM - 624                  |
| |PAUSE                  |                                                           |
| |DISABLE                |                                                           |
| |TS12                   |                                                           |
| |  N7:16                |                                                           |
| +----] [----------------+                                                           |
|       4                                                                             |
|  [2:3]                                                                              |
```

```
BASE :  Rung #227
| COMPRESSOR  CRYO 5                                                          REROUGH    |
| 5 REGEN-    COUNTER                                                         COUNTER    |
| ERATION     RESET                                                           COMPRESSOR |
| PROGRAM     ONE SHOT                                                        5          |
| CYRGN5      C5CROS                                                          C5RERUF    |
|     B3          B3                                                              C5:5   |
|-+---]/[-------[ONS]--+-----------------------------------------------------------(RES)-----|
| |   325         565  |                                                                 |
| |[241]               |                                                                 |
| |                    | C5:5 - CTU - File #3 CRYO_REGEN - 199                           |
| |                    | C5:5.DN - ] [ - File #2 MAIN_PRGRM - 624                        |
| |PAUSE               |                                                                 |
| |DISABLE             |                                                                 |
| |TS12                |                                                                 |
| |  N7:16             |                                                                 |
| +---] [--------------+                                                                 |
|      4                                                                                 |
|  [2:3]                                                                                 |
```

551

BASE : Rung #228

```
| COMPRESSOR  CRYO 6                                                        REROUGH     |
| 6 REGEN-    COUNTER                                                       COUNTER     |
| ERATION     RESET                                                         COMPRESSOR  |
| PROGRAM     ONE SHOT                                                      6           |
| CYRGN6      C6CROS                                                        C6R3RUF     |
|     B3          B3                                                           C5:6     |
|-+---]/[------[ONS]--+-------------------------------------------------------[RES]----|
| |   326         566 |                                                                 |
| |[242]              |                                                                 |
| |                   | C5:6 - CTU - File #3 CRYO_REGEN - 200                           |
| |                   | C5:6.DN - ]  [ - File #2 MAIN_PRGRM - 624                       |
| |PAUSE              |                                                                 |
| |DISABLE            |                                                                 |
| |TS12               |                                                                 |
| |  N7:16            |                                                                 |
| +---] [-------------+                                                                 |
|      4                                                                                |
|  [2:3]                                                                                |
```

```
BASE :   Rung #229
| COMPRESSOR  CRYO 7                                                  REROUGH     |
| 7 REGEN-    COUNTER                                                 COUNTER     |
| ERATION     RESET                                                   COMPRESSOR  |
| PROGRAM     ONE SHOT                                                7           |
| CYRGN7      C7CROS                                                  C7RERUF     |
|       B3         B3                                                     C5:7    |
|-+----]/[-------[ONS]-+--------------------------------------------------[RES]---|
| |     327        567 |                                                          |
| |[243]               |                                                          |
| |                    | C5:7 - CTU - File #3 CRYO_REGEN - 201                    |
| |                    | C5:7.DN - ] [ - File #2 MAIN_PRGRM - 624                 |
| |PAUSE               |                                                          |
| |DISABLE             |                                                          |
| |TS12                |                                                          |
| |  N7:16             |                                                          |
| +----] [-------------+                                                          |
|       4                                                                         |
|  [2:3]
```

```
BASE :  Rung #230
| COMPRESSOR  CRYO 8                                                    REROUGH     |
| 8 REGEN-    COUNTER                                                   COUNTER     |
| ERATION     RESET                                                     COMPRESSOR  |
| PROGRAM     ONE SHOT                                                  8           |
| CYRGN8      C8CROS                                                  C8RERUF     |
|       B3         B3                                                    C5:8     |
|-+----]/[-------[ONS]--+------------------------------------------------[RES]-----|
| |    328        568   |                                                           |
| |[244]                |                                                           |
| |                     | C5:8 - CTU - File #3 CRYO_REGEN - 202                     |
| |                     | C5:8.DN - ] [ - File #2 MAIN_PRGRM - 624                  |
| |PAUSE                |                                                           |
| |DISABLE              |                                                           |
| |TS12                 |                                                           |
| |  N7:16              |                                                           |
| +----] [--------------+                                                           |
|       4                                                                           |
|  [2:3]                                                                            |
```

```
Rung #231
|COMPRESSOR                                                                         |
|2 REGEN-                                                                           |
|ERATION                                                            COOL DOWN       |
|PROGRAM                                                            2               |
|CYRGN2                                                             CD2             |
|      B3                                                                  B3       |
|----]/[-------------------------------------------------------------------(U)------|
      322                                                                 652      |
|[238]                                                                              |
B3/652 - ] [ - File #2 MAIN_PRGRM -  27,117,118
               File #3 CRYO_REGEN -  164,210,217,238
               File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  203
        -(U)- - File #3 CRYO_REGEN -  231
```

Rung #232

```
|COMPRESSOR                                                        |
|3 REGEN-                                              COOL DOWN   |
|ERATION                                               3           |
|PROGRAM                                               CD3         |
|CYRGN3                                                   B3       |
|     B3                                                           |
|----|/|-----------------------------------------------------(U)---|
|     323                                                  653     |
|[239]
B3/653 - -| |- - File #2 MAIN_PRGRM -  28,119,120
                 File #3 CRYO_REGEN -  165,211,218,239
                 File #6 TECH_RUNGS -  19
          -(L)- - File #3 CRYO_REGEN -  204
          -(U)- - File #3 CRYO_REGEN -  232
```

Rung #233

```
|COMPRESSOR                                                        |
|4 REGEN-                                              COOL DOWN   |
|ERATION                                               4           |
|PROGRAM                                               CD4         |
|CYRGN4                                                   B3       |
|     B3                                                           |
|----|/|-----------------------------------------------------(U)---|
|     324                                                  654     |
|[240]
B3/654 - -| |- - File #2 MAIN_PRGRM -  29,123,124
                 File #3 CRYO_REGEN -  166,212,219,240
                 File #6 TECH_RUNGS -  19
          -(L)- - File #3 CRYO_REGEN -  205
          -(U)- - File #3 CRYO_REGEN -  233
```

Rung #234

```
|COMPRESSOR                                                        |
|5 REGEN-                                              COOL DOWN   |
|ERATION                                               5           |
|PROGRAM                                               CD5         |
|CYRGN5                                                   B3       |
|     B3                                                           |
|----|/|-----------------------------------------------------(U)---|
|     325                                                  655     |
|[241]
B3/655 - -| |- - File #2 MAIN_PRGRM -  30,121,122,125,126,127,128
                 File #3 CRYO_REGEN -  167,168,169,213,220,241
                 File #6 TECH_RUNGS -  19
          -(L)- - File #3 CRYO_REGEN -  206
          -(U)- - File #3 CRYO_REGEN -  234
```

Rung #235

```
|COMPRESSOR                                                        |
|6 REGEN-                                              COOL DOWN   |
 RATION                                                6           |
 ROGRAM                                                CD6         |
|CYRGN6                                                   B3       |
|     B3                                                           |
|----|/|-----------------------------------------------------(U)---|
|     326                                                  656     |
|[242]
B3/656 - -| |- - File #2 MAIN_PRGRM -  31,129,130
                 File #3 CRYO_REGEN -  170,214,221,242
                 File #6 TECH_RUNGS -  19
          -(L)- - File #3 CRYO_REGEN -  207
          -(U)- - File #3 CRYO_REGEN -  235
```

Rung #236

```
|COMPRESSOR                                                        |
|7 REGEN-                                                          |
|ERATION                                               COOL DOWN   |
|PROGRAM                                               7           |
|CYRGN7                                                CD7         |
|    B3                                                   B3       |
|----]/[---------------------------------------------------(U)-----|
|   327                                                   657      |
|[243]                                                             |
B3/657 - ] [ - File #2 MAIN_PRGRM -  32,131,132,133,134,137,138
               File #3 CRYO_REGEN -  171,172,173,215,222,243
               File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  208
        -(U)- - File #3 CRYO_REGEN -  236
```

Rung #237

```
|COMPRESSOR                                                        |
|8 REGEN-                                                          |
|ERATION                                               COOL DOWN   |
|PROGRAM                                               8           |
|CYRGN8                                                CD8         |
|    B3                                                   B3       |
|----]/[---------------------------------------------------(U)-----|
|   328                                                   658      |
|[244]                                                             |
B3/658 - ] [ - File #2 MAIN_PRGRM -  33,135,136
               File #3 CRYO_REGEN -  174,216,223,244
               File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  209
        -(U)- - File #3 CRYO_REGEN -  237
```

556

Rung #238

```
                  CRYO 2                                              COMPRESSOR
   COOL DOWN      TEMPERATUR                                          2 REGEN-
   2              =<20K                                               ERATION
   CD2            CY2TMP20                                            PROGRAM
                                                                      CYRGN2
      B3            B3                                                  B3
|--+---] [---------] [----+----------------------------------------+----(U)----+--|
|  |   652           502  |                                        |    322    |
|  |[231]                 |                                        |           |
|  |                      | B3/322 - ] [ - File #2 MAIN_PRGRM - 110, 117, 118, 460, 462
|  |                      |            File #3 CRYO_REGEN - 35, 37, 67, 74, 210, 245, 252,
|  |                      |            259
|  |                      |            File #6 TECH_RUNGS - 14     |MANUAL     |
|  |                      |      ]/[ - File #2 MAIN_PRGRM - 27, 117, 118
|  |                      |            File #3 CRYO_REGEN - 33, 117, 135, 143, 176, 210, 224,
|  |                      |            231                         |COMPRESSOR 2
|  |ABORT CRYO  REGENERATE|      -(L)- File #3 CRYO_REGEN - 34     |REGENERATION
|  |TIMER       CRYO 2    | N7:36/10 - -(L)- - File #3 CRYO_REGEN - 34
|  |ABORTCRYO   TS02      | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
|  |  T4:297     N7:15    |                                        |ENABLE     |
|  |---] [----+---] [---+-|                                        |MC2RE      |
|  |    TT    |    10   | |                                        |  N7:36    |
|  |[27]      |[2:3]    | |                                        +----(U)----+
|  |          |REGENERATE |                                             10
|  |          |ALL CRYO'S |
|  |          |TS20     | |
|  |          |  N7:16  | |
|  |          +---] [---+ |
|  |               12     |
|  |             [2:3]    |
|  |PIRANI                |
|  |GUAGE 2               |
|  |NO FAULT              |
|  |PGNF2                 |
|  |  I:004               |
|  |---]/[----------------|
|  |    15                |
|  |CRYO RE-              |
|  |GENERATION            |
|  |FAULT                 |
|  |COMPRESSOR            |
|  |2                     |
|  |CRFLT2                |
|  |    B3                |
|  |---] [----------------|
|  |   332                |
|  |[252]                 |
|  |PREPARE FOR           |
|  |AUTO RUN              |
|  |>AUTO                 |
|  |   N7:37              |
|  +---] [----------------+
|        1
|   [2:157]
```

Rung #239

```
                                                                                        COMPRESSOR
                                                                                        3 REGEN-
 COOL DOWN  CRYO 3                                                                      ERATION
 3          TEMPERATUR                                                                  PROGRAM
 CD3        =<20K                                                                       CYRGN3
            CY3TMP20                                                                       B3
    B3         B3
 ---] [--------] [----------------------------------------------------------------------(U)---
   653         503                                                                        323
 [232]
          B3/323 - ] [ - File #2 MAIN_PRGRM - 111, 119, 120, 464, 466                   MANUAL
                         File #3 CRYO_REGEN - 39, 41, 68, 75, 211, 246, 253,            COMPRESSOR 3
                         259                                                            REGENERATION
                         File #6 TECH_RUNGS - 14                                        ENABLE
                   ]/[ - File #2 MAIN_PRGRM - 28, 119, 120                              MC3RE
                         File #3 CRYO_REGEN - 33, 118, 136, 145, 178, 211, 225,            N7:36
                         232                                                            ---(U)---
                  -(L)- - File #3 CRYO_REGEN - 38                                          11
          N7:36/11 - -(L)- - File #3 CRYO_REGEN - 38
          _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
 ABORT CRYO    REGENERATE
 TIMER         CRYO 3
 ABORTCRYO     TS03
   T4:297        N7:15
 ---] [---------] [---
    TT            11
 [27]          [2:3]
               REGENERATE
               ALL CRYO'S
               TS20
                 N7:16
               --] [--
                  12
               [2:3]
 PIRANI
 GUAGE 2
 NO FAULT
 PGNF2
   I:004
 ---]/[---
    15
 CRYO RE-
 GENERATION
 FAULT
 COMPRESSOR
 3
 CRFLT3
    B3
 ---] [---
    333
 [253]
 PREPARE FOR
 AUTO RUN
 >AUTO
    N7:37
 ---] [---
     1
 [2:157]
```

Rung #240

```
                    CRYO 5                                                      COMPRESSOR
 COOL DOWN          TEMPERATUR                                                  4 REGEN-
 4                  =<20K                                                       ERATION
 CD4                CY5TMP20                                                    PROGRAM
                                                                                CYRGN4
     B3                 B3                                                          B3
 ---] [------------] [-------------------------------------------------------------(U)---
     654                505                                                         324
 [233]
                                  B3/324 - ] [ - File #2 MAIN_PRGRM - 111, 123, 124, 470, 472, 474      MANUAL
                                                 File #3 CRYO_REGEN - 43, 45, 69, 76, 212, 247, 254,     COMPRESSOR 4
                                                 259                                                     REGENERATION
                                                 File #6 TECH_RUNGS - 14                                 ENABLE
                                             ]/[ - File #2 MAIN_PRGRM - 29, 123, 124                     MC4RE
 ABORT CRYO         REGENERATE                   File #3 CRYO_REGEN - 33, 119, 137, 149, 180, 212, 226,     N7:36
 TIMER              CRYO 4                       233                                                    --(U)--
 ABORTCRYO          TS04                                                                                  12
   T4:297              N7:15                 -(L)- - File #3 CRYO_REGEN - 42
 ---] [------------] [-----       N7:36/12 - -(L)- - File #3 CRYO_REGEN - 42
      TT                12        _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
 [27]               [2:3]
                    REGENERATE
                    ALL CRYO'S
                    TS20
                       N7:16
                    ---] [---
                        12
                    [2:3]
 PIRINI
 GUAGE 4
 NO FAULT
 PGNF4
   I:024
 ---]/[---
     15
 CRYO RE-
 GENERATION
 FAULT
 COMPRESSOR
 4
 CRFLT4
     B3
 ---] [---
     334
 [254]
 PREPARE FOR
 AUTO RUN
 >AUTO
    N7:37
 ---] [---
     1
 [2:157]
```

559

Rung #241

```
                     CRYO 4       CRYO 6       CRYO 7                                         COMPRESSOR
 COOL DOWN           TEMPERATUR   TEMPERATUR   TEMPERATUR                                     5 REGEN-
 5                   =<20K        =<20K        =<20K                                          ERATION
 CD5                 CY4TMP20     CY6TMP20     CY7TMP20                                       PROGRAM
    B3                  B3           B3           B3                                          CYRGN5
                                                                                                B3
|--| |-------------| |--------| |--------| |---------------------------------------------------(U)---
   655                 504          506          507                                            325
 [234]
                                                    B3/325 - -| |- - File #2 MAIN_PRGRM - 111, 112, 121, 122,    MANUAL
                                                                125, 126, 127, 128, 468, 476, 478,            COMPRESSOR 5
                                                                480, 482                                      REGENERATION
                                                                File #3 CRYO_REGEN - 47, 51, 70, 77,          ENABLE
 ABORT CRYO       REGENERATE                                    213, 248, 255, 259                            MC5RE
 TIMER            CRYO 5                                        File #6 TECH_RUNGS - 14                         N7:36
 ABORTCRYO        TS05                                -|/|- - File #2 MAIN_PRGRM - 30, 121, 122, 125,       ----(U)----
    T4:297          N7:15                                       126, 127, 128                                    13
|--| |----------+--| |--+                                       File #3 CRYO_REGEN - 33, 120, 121, 122,
      TT        |   13  |                                       138, 147, 151, 153, 182, 213, 227,
 [27]           |[2:3]  |                                       234
                |       |                             -(L)- - File #3 CRYO_REGEN - 46
                |       |                       N7:36/13 - -(L)- - File #3 CRYO_REGEN - 46
                |       |                       _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
                |REGENERATE
                |ALL CRYO'S
                |TS20
                |   N7:16
                +--| |--+
                    12
                 [2:3]
 PIRINI
 GUAGE 3
 NO FAULT
 PGNF3
   I:024
|--|/|--------------------
    14
 PIRINI
 GUAGE 4
 NO FAULT
 PGNF4
   I:024
|--|/|--------------------
    15
 PIRINI
 GUAGE 5
 NO FAULT
 PGNF5
   I:040
|--|/|--------------------
    14
 CRYO RE-
 GENERATION
 FAULT
 COMPRESSOR
 5
 CRFLT5
    B3
|--| |--------------------
    335
 [255]
 PREPARE FOR
> >                                          >                                                          >
```

560

```
AUTO RUN
>AUTO
N7:37
1
[2:157]
Rung #242
COOL DOWN 6 CD6          CRYO 8 TEMPERATUR =<20K CY8TMP20
B3 656                   B3 508
[235]
ABORT CRYO TIMER ABORTCRYO   REGENERATE CRYO 6 TS06
T4:297 TT                    N7:15 14
[27]                         [2:3]
                             REGENERATE ALL CRYO'S TS20
                             N7:16 12
                             [2:3]
PIRINI GUAGE 6 NO FAULT PGNF6
I:040 15
CRYO RE-GENERATION FAULT COMPRESSOR 6 CRFLT6
B3 336
[256]
PREPARE FOR AUTO RUN >AUTO
N7:37 1
[2:157]

B3/326 - -| |- - File #2 MAIN_PRGRM - 112, 129, 130, 484, 486
                  File #3 CRYO_REGEN - 54, 56, 71, 78, 214, 249, 256, 259
                  File #6 TECH_RUNGS - 14
         -|/|- - File #2 MAIN_PRGRM - 31, 129, 130
                  File #3 CRYO_REGEN - 33, 123, 139, 155, 184, 214, 228, 235
         -(L)- - File #3 CRYO_REGEN - 52, 53
N7:36/14 - -(L)- - File #3 CRYO_REGEN - 52, 53
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6
B3 -(U)- 326
MANUAL COMPRESSOR 6 REGENERATION ENABLE MC6RE
N7:36 -(U)- 14
```

561

Rung #243

COOL DOWN 7 CD7 B3 657 [236]

CRYO 9 TEMPERATUR =<20K CY9TMP20 B3 509

CRYO 10 TEMPERATUR =<20K CY10TMP20 B3 510

CRYO 12 TEMPERATUR =<20K CY12TMP20 B3 512

COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 (U) 327

ABORT CRYO TIMER ABORTCRYO T4:297 TT [27]

REGENERATE CRYO 7 TS07 N7:15 15 [2:3]

REGENERATE ALL CRYO'S TS20 N7:16 12 [2:3]

PIRINI GUAGE 6 NO FAULT PGNF6 I:040 15

PIRINI GUAGE 8 NO FAULT PGNF8 I:054 15

CRYO RE-GENERATION FAULT COMPRESSOR

CRFLT7 B3 337 [257]

PREPARE FOR AUTO RUN >AUTO N7:37 1 [2:157]

B3/327 - ┤ ├ - File #2 MAIN_PRGRM - 113, 114, 131, 132, 133, 134, 137, 138, 488, 490, 492, 494, 500, 502
File #3 CRYO_REGEN - 58, 62, 72, 79, 215, 250, 257, 259
File #6 TECH_RUNGS - 14
┤/├ - File #2 MAIN_PRGRM - 32, 131, 132, 133, 134, 137, 138
File #3 CRYO_REGEN - 33, 124, 125, 126, 140, 157, 159, 163, 186, 215, 229, 236
-(L)- - File #3 CRYO_REGEN - 57
N7:36/15 - -(L)- - File #3 CRYO_REGEN - 57
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2

MANUAL COMPRESSOR 7 REGENERATION ENABLE MC7RE N7:36 (U) 15

562

Rung #244

```
                                                                      COMPRESSOR
                                                                      8 REGEN-
              CRYO 11                                                 ERATION
 COOL DOWN    TEMPERATUR                                              PROGRAM
 8            =<20K                                                   CYRGM8
 CD8          CY11TMP20                                                  B3
   B3            B3                                                   --(U)--
---| |-----------| |---                                                 328
   658           511
 [237]                   B3/328 - -| |- - File #2 MAIN_PRGRM - 113, 135, 136, 496, 498
                                          File #3 CRYO_REGEN - 64, 66, 73, 80, 216, 251, 258,
                                          259                                   MANUAL
                                          File #6 TECH_RUNGS - 14               COMPRESSOR 8
                                  -|/|- - File #2 MAIN_PRGRM - 33, 135, 136     REGENERATION
                                          File #3 CRYO_REGEN - 33, 127, 141, 161, 188, 216, 230,   ENABLE
                                          237                                   MC8RE
                                  -(L)- - File #3 CRYO_REGEN - 63                 N7:37
                         N7:37/0 - -(L)- - File #3 CRYO_REGEN - 63              ---(U)---
                         _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                 0

 ABORT CRYO      REGENERATE
 TIMER           CRYO 8
 ABORTCRYO       TS08
   T4:297          N7:16
---| |---------+---| |---+---
   TT          |    0    |
 [27]          | [2:3]   |
               | REGENERATE
               | ALL CRYO'S
               | TS20    |
               |  N7:16  |
               +---| |---+
                   12
                 [2:3]

 PIRINI
 GUAGE 8
 NO FAULT
 PGNF8
   I:054
---|/|---------------------
   15
 CRYO RE-
 GENERATION
 FAULT
 COMPRESSOR
 8
 CRFLT8
   B3
---| |---------------------
   338
 [258]
 PREPARE FOR
 AUTO RUN
 >AUTO
   N7:37
---| |---------------------
    1
 [2:157]
```

```
Rung #245
|COMPRESSOR  HEATER 2                                   CRYO REGEN            |
|2 REGEN-    CHAMBER                                    COMPRESSOR            |
|ERATION     GATE VALVE                                 2 HV2 FAULT           |
|PROGRAM     CLOSE                                      CR2FLT                |
|CYRGN2      HV2S1                                     +-TON-------------+    |
|    B3       I:004                                    |                 |    |
|----| |-------|/|--------------------------------------+TIMER ON DELAY   +-(EN)-|
|   322        00                                      |TIMER:     T4:12 |    |
|[238]                                                 |BASE (SEC):  1.0 +-(DN) |
|                                                      |PRESET:       30 |    |
|                                                      |ACCUM:         0 |    |
|                                                      +-----------------+    |
T4:12.DN - -| |- - File #3 CRYO_REGEN -  252
Rung #246
|COMPRESSOR  DWELL 1                                    CRYO REGEN            |
|3 REGEN-    CHAMBER                                    COMPRESSOR            |
|ERATION     GATE VALVE                                 3 HV3 FAULT           |
|PROGRAM     CLOSED                                     CR3FLT                |
|CYRGN3      HV3S1                                     +-TON-------------+    |
|    B3       I:004                                    |                 |    |
|----| |-------|/|--------------------------------------+TIMER ON DELAY   +-(EN)-|
|   323        03                                      |TIMER:     T4:13 |    |
|[239]                                                 |BASE (SEC):  1.0 +-(DN) |
|                                                      |PRESET:       30 |    |
|                                                      |ACCUM:         0 |    |
|                                                      +-----------------+    |
  13.DN - -| |- - File #3 CRYO_REGEN -  253
Rung #247
|COMPRESSOR  HEATER 3                                   CRYO REGEN            |
|4 REGEN-    CHAMBER                                    COMPRESSOR            |
|ERATION     GATE VALVE                                 4 HV5 FAULT           |
|PROGRAM     CLOSED                                     CR5FLT                |
|CYRGN4      HV5S1                                     +-TON-------------+    |
|    B3       I:024                                    |                 |    |
|----| |-------|/|--------------------------------------+TIMER ON DELAY   +-(EN)-|
|   324        00                                      |TIMER:     T4:14 |    |
|[240]                                                 |BASE (SEC):  1.0 +-(DN) |
|                                                      |PRESET:       30 |    |
|                                                      |ACCUM:         0 |    |
|                                                      +-----------------+    |
T4:14.DN - -| |- - File #3 CRYO_REGEN -  254
```

564

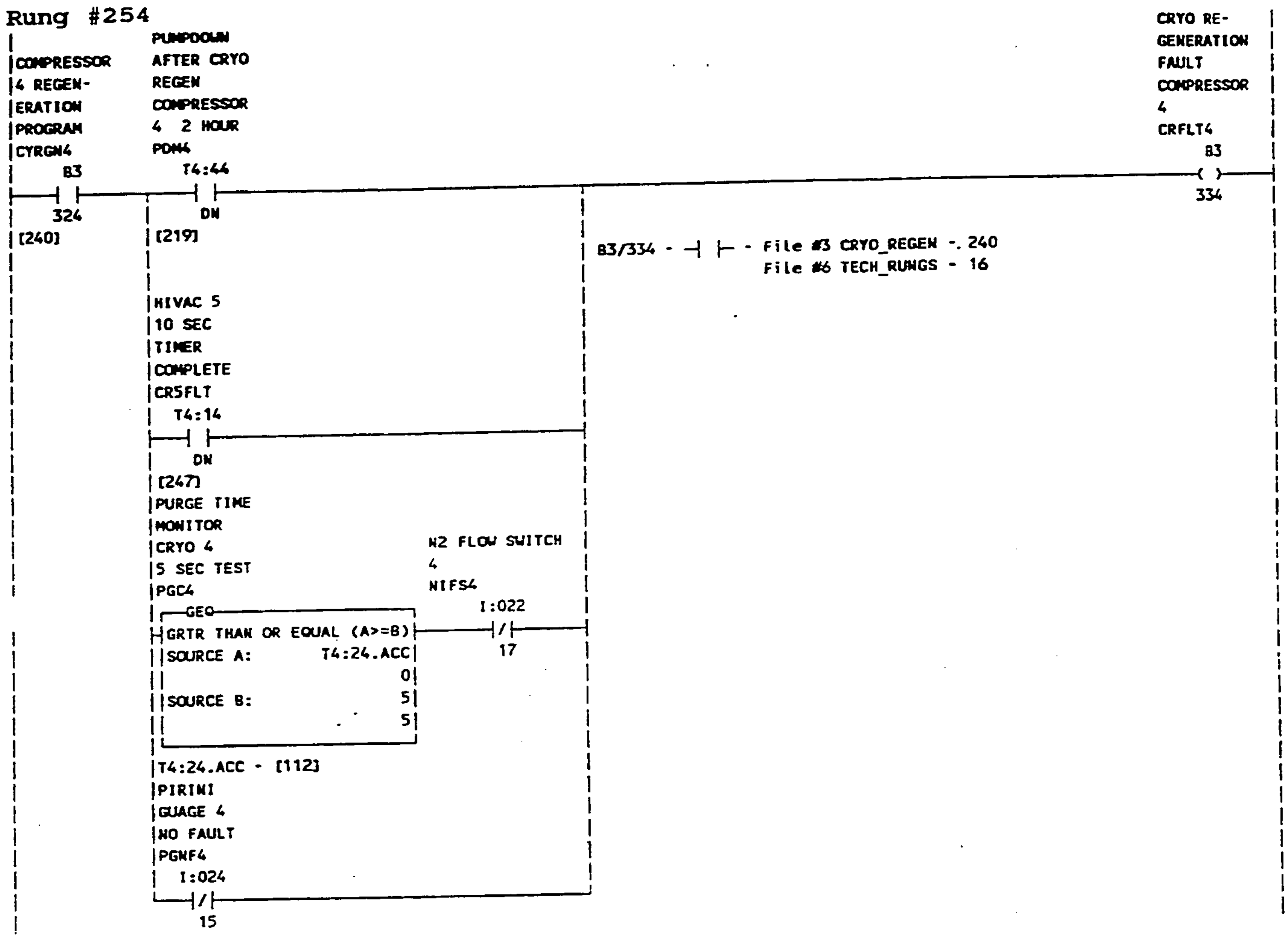
```
Rung #248
|COMPRESSOR    DWELL 2                                                  CRYO REGEN
|5 REGEN-      CHAMBER                                                  COMPRESSOR
|ERATION       GATE VALVE                                               5 HV4,6,7 FAULT
|PROGRAM       CLOSED                                                   CR467FLT
|CYRGN5        HV4S1                                                    +--TON--------------+
|    B3          I:022                                                  |TIMER ON DELAY     |-(EN)-
|---] [----+-----]/[-----+------------------------------------------------|TIMER:        T4:15|
|   325    |      06     |                                              |BASE (SEC):    1.0|-(DN)
|[241]     |             |                                              |PRESET:         30|
|          |DWELL 3      | T4:15.DN - ] [ - File #3 CRYO_REGEN - 255    |ACCUM:           0|
|          |CHAMBER      |                                              +-------------------+
|          |GATE VALVE   |
|          |CLOSED       |
|          |HV6S1        |
|          |   I:024     |
|          +----]/[------+
|          |    03       |
|          |DWELL 4      |
|          |CHAMBER      |
|          |GATE VALVE   |
|          |CLOSED       |
|          |HV7S1        |
|          |   I:036     |
|          +----]/[------+
|               06
Rung #249
 COMPRESSOR    BUFFER 3                                                 CRYO REGEN
|5 REGEN-      CHAMBER                                                  COMPRESSOR
|ERATION       GATE VALVE                                               6 HV8 FAULT
|PROGRAM       CLOSED                                                   CR8FLT
|CYRGN6        HV8S1                                                    +--TON--------------+
|    B3          I:040                                                  |TIMER ON DELAY     |-(EN)-
|---] [----------]/[------------------------------------------------------|TIMER:        T4:16|
|   326           00                                                    |BASE (SEC):    1.0|-(DN)
|[242]                                                                  |PRESET:         30|
|                                                                       |ACCUM:           0|
|                                                                       +-------------------+
T4:16.DN - ] [ - File #3 CRYO_REGEN - 256
```

```
Rung #250
|COMPRESSOR   DWELL 5                                                    CRYO REGEN
|7 REGEN-     CHAMBER                                                    COMPRESSOR
|ERATION      GATE VALVE                                                 7 HV91012 FAULT
|PROGRAM      CLOSED                                                     CR91012FLT
|CYRGN7       HV9S1                                                      +-TON-----------+
|    B3        I:040                                                     |TIMER ON DELAY |-(EN)-
|---| |------+--|/|--+-------------------------------------------------- |TIMER:    T4:17|
|   327      |   03  |                                                   |BASE (SEC): 1.0|-(DN)
|[243]       |       |                                                   |PRESET:      30|
|            |DWELL 6| T4:17.DN - -| |- - File #3 CRYO_REGEN - 257       |ACCUM:        0|
|            |CHAMBER|                                                   +---------------+
|            |GATE VALVE
|            |CLOSED |
|            |HV10S1 |
|            | I:052 |
|            +--|/|--+
|            |   06  |
|            |EXITLOCK
|            |CHAMBER|
|            |GATE VALVE
|            |CLOSED |
|            |HV12S1 |
|            | I:054 |
|            +--|/|--+
|                03
Rung #251
 MPRESSOR   BUFFER 4                                                     CRYO REGEN
|- REGEN-   CHAMBER                                                      COMPRESSOR
|ERATION    GATE VALVE                                                   8 HV11 FAULT
|PROGRAM    CLOSED                                                       CR11FLT
|CYRGN8     HV11S1                                                       +-TON-----------+
|    B3      I:054                                                       |TIMER ON DELAY |-(EN)-
|---| |--------|/|------------------------------------------------------ |TIMER:    T4:18|
|   328       00                                                         |BASE (SEC): 1.0|-(DN)
|[244]                                                                   |PRESET:      30|
|                                                                        |ACCUM:        0|
|                                                                        +---------------+
T4:18.DN - -| |- - File #3 CRYO_REGEN - 258
```

```
Rung #252
                                                                                   CRYO RE-
|          COOL DOWN                                                               GENERATION
|COMPRESSOR AFTER CRYO                                                             FAULT
|2 REGEN-   REGEN                                                                  COMPRESSOR
|ERATION    CRYO 2                                                                 2
|PROGRAM    2 HOUR                                                                 CRFLT2
|CYRGN2     POM2                                                                     B3
|   B3       T4:42                                                                 
|---| |-----+---| |-----+--------------------------------------------------------------( )---|
|   322     |   DN      |                                                             332
|[238]      |[217]      | B3/332 - -| |- - File #3 CRYO_REGEN - 238
|           |           |              File #6 TECH_RUNGS - 16
|           |           |
|           |HIVAC 2    |
|           |10 SEC     |
|           |TIMER      |
|           |COMPETE    |
|           |CR2FLT     |
|           |  T4:12    |
|           |---| |-----+
|           |   DN      |
|           |[245]      |
|           |PURGE TIME |
|           |MONITOR    |
|           |COMPRESSOR 2          N2 FLOW SWITCH
|           |5 SECOND TEST         2
|           |PGC2                  NIFS2
|           | +-GEQ-----------------+  I:002   |
|           |-|GRTR THAN OR EQUAL (A>=B)|---|/|-----+
|           | |SOURCE A:     T4:22.ACC|   17    |
|           | |                     0|          |
|           | |SOURCE B:            5|          |
|           | |                     5|          |
|           | +---------------------+           |
|           |T4:22.ACC - [110]                  |
|           |PIRANI                             |
|           |GUAGE 2                            |
|           |NO FAULT                           |
|           |PGNF2                              |
|           |  I:004                            |
|           +---|/|-----------------------------+
|               15
```

Rung #253

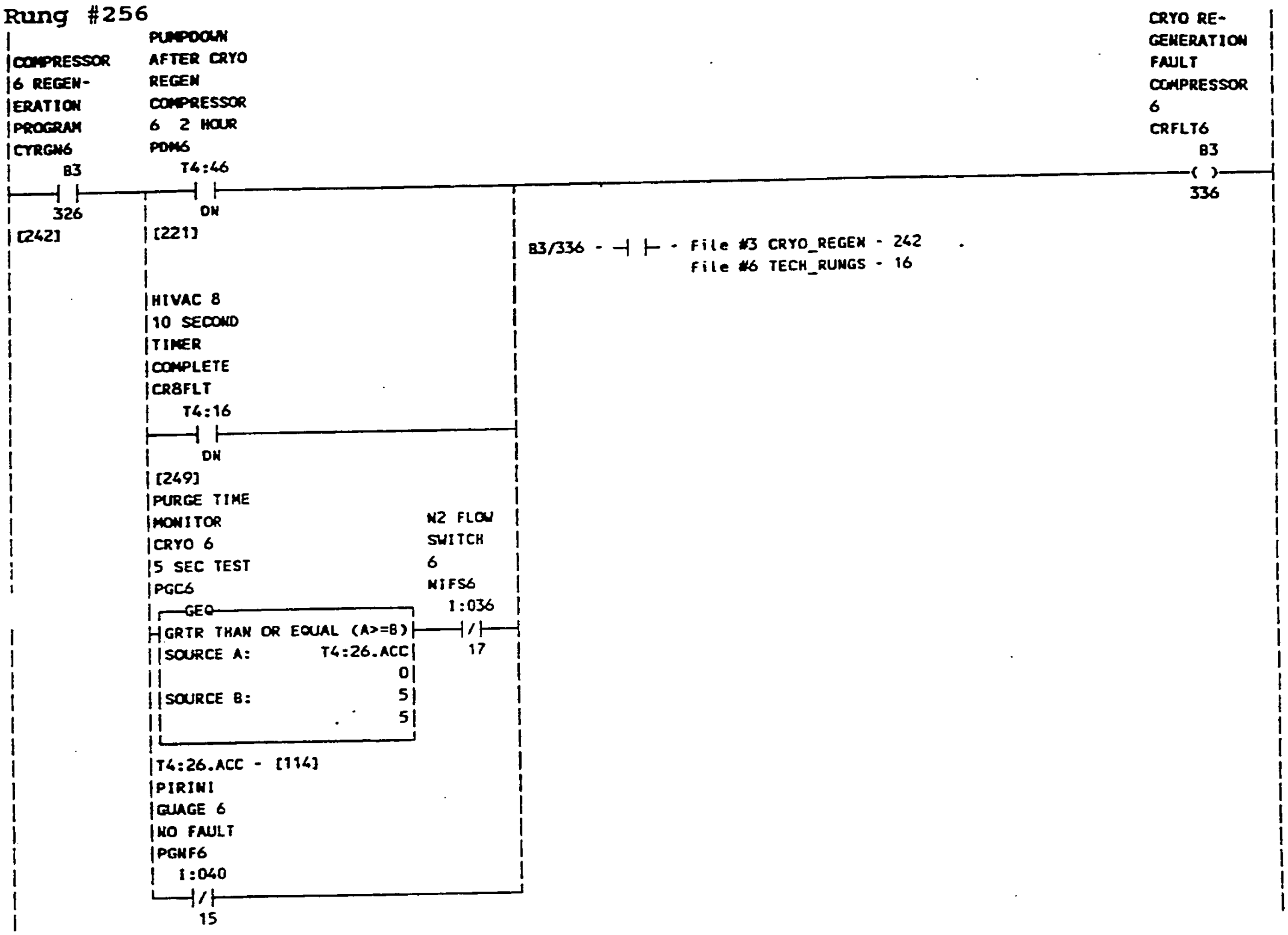
```
|            PUMPDOWN                                                              CRYO RE-     |
|COMPRESSOR  AFTER CRYO                                                            GENERATION   |
|3 REGEN-    REGEN                                                                 FAULT        |
|ERATION     COMPRESSOR                                                            COMPRESSOR   |
|PROGRAM     3  2 HOUR                                                             3            |
|CYRGM3      PDM3                                                                  CRFLT3       |
|   B3         T4:43                                                                  B3        |
|----] [------+---] [---------------+--------------------------------------------------( )------|
|   323       |    DN               |                                                 333       |
|[239]        |[218]                |                                                           |
|             |                     | B3/333 - -] [- - File #3 CRYO_REGEN - 239                 |
|             |                     |                  File #6 TECH_RUNGS - 16                  |
|             |HIVAC 3              |                                                           |
|             |10 SEC               |                                                           |
|             |TIMER                |                                                           |
|             |COMPLETE             |                                                           |
|             |CR3FLT               |                                                           |
|             |  T4:13              |                                                           |
|             +---] [---------------+                                                           |
|             |    DN               |                                                           |
|             |[246]                |                                                           |
|             |PURGE TIME           |                                                           |
|             |MONITOR              |                                                           |
|             |CRYO 3               N2 FLOW SWITH                                                |
|             |5 SEC TEST           3                                                            |
|             |PGC3                 NIFS3                                                        |
|             | +-GEQ-------------------+  I:022   |                                              |
|             +-|GRTR THAN OR EQUAL (A>=B)|---]/[----+                                            |
|             | |SOURCE A:      T4:23.ACC|    00   |                                              |
|             | |                        0|        |                                              |
|             | |SOURCE B:               5|        |                                              |
|             | |                        5|        |                                              |
|             | +------------------------+        |                                              |
|             |T4:23.ACC - [111]                  |                                              |
|             |PIRANI                             |                                              |
|             |GUAGE 2                            |                                              |
|             |NO FAULT                           |                                              |
|             |PGNF2                              |                                              |
|             |  I:004                            |                                              |
|             +---]/[-----------------------------+                                              |
|                 15                                                                             |
```


Rung #254
COMPRESSOR 4 REGEN- ERATION PROGRAM CYRGN4
B3
324
[240]
PUMPDOWN AFTER CRYO REGEN COMPRESSOR 4 2 HOUR PDN4
T4:44
DN
[219]
HIVAC 5 10 SEC TIMER COMPLETE CR5FLT
T4:14
DN
[247]
PURGE TIME MONITOR CRYO 4 5 SEC TEST PGC4
GEQ
GRTR THAN OR EQUAL (A>=B)
SOURCE A: T4:24.ACC
0
SOURCE B: 5
5
T4:24.ACC - [112]
PIRINI GUAGE 4 NO FAULT PGNF4
I:024
15
N2 FLOW SWITCH 4 NIFS4
I:022
17
CRYO RE- GENERATION FAULT COMPRESSOR 4 CRFLT4
B3
334
B3/334 - File #3 CRYO_REGEN - 240
File #6 TECH_RUNGS - 16

Rung #255

```
|                                                                                  CRYO RE-      |
|           PUMPDOWN                                                               GENERATION    |
|COMPRESSOR AFTER CRYO                                                             FAULT         |
|5 REGEN-   REGEN                                                                  COMPRESSOR    |
|ERATION    COMPRESSOR                                                             5             |
|PROGRAM    5  2 HOUR                                                              CRFLT5        |
|CYRGN5     PDM5                                                                   B3            |
|   B3        T4:45                                                                              |
|---| |----+---| |-------------+----------------------------------------------------( )---------|
|   325    |     DN            |                                                   335           |
|[241]     |[220]              |                                                                 |
|          |                   | B3/335 - -| |- - File #3 CRYO_REGEN - 241                       |
|          |                   |                  File #6 TECH_RUNGS - 16                        |
|          |HIVAC 4,6,7        |                                                                 |
|          |10 SEC             |                                                                 |
|          |TIMER              |                                                                 |
|          |COMPLETE           |                                                                 |
|          |CR467FLT           |                                                                 |
|          |   T4:15           |                                                                 |
|          +---| |-------------+                                                                 |
|          |     DN            |                                                                 |
|          |[248]              |                                                                 |
|          |PURGE TIME         |                                                                 |
|          |MONITOR            |                                                                 |
|          |CRYO 5        SWITCH                                                                 |
|          |5 SEC TEST    5    |                                                                 |
|          |PGC5          NIFS5                                                                  |
|          | +-GEQ------------+ I:036                                                           |
|          +-|GRTR THAN OR EQUAL (A>=B)|---|/|---+                                               |
|          | |SOURCE A:     T4:25.ACC|   00     |                                               |
|          | |                      0|          |                                               |
|          | |SOURCE B:             5|          |                                               |
|          | |                      5|          |                                               |
|          | +-----------------------+          |                                               |
|          |T4:25.ACC - [113]                  |                                               |
|          |PIRINI                             |                                               |
|          |GUAGE 3                            |                                               |
|          |NO FAULT                           |                                               |
|          |PGNF3                              |                                               |
|          |  I:024                            |                                               |
|          +---|/|-----------------------------+                                               |
|          |    14                             |                                               |
|          |PIRINI                             |                                               |
|          |GUAGE 4                            |                                               |
|          |NO FAULT                           |                                               |
|          |PGNF4                              |                                               |
|          |  I:024                            |                                               |
|          +---|/|-----------------------------+                                               |
|          |    15                             |                                               |
|          |PIRINI                             |                                               |
|          |GUAGE 5                            |                                               |
|          |NO FAULT                           |                                               |
|          |PGNF5                              |                                               |
|          |  I:040                            |                                               |
|          +---|/|-----------------------------+                                               |
|               14                                                                              |
```

570


Rung #256
COMPRESSOR 6 REGEN- ERATION PROGRAM CYRGN6
B3
326
[242]
PUMPDOWN AFTER CRYO REGEN COMPRESSOR 6 2 HOUR PDM6
T4:46
DN
[221]
CRYO RE- GENERATION FAULT COMPRESSOR 6 CRFLT6
B3
336
B3/336 - ⊣ ⊢ - File #3 CRYO_REGEN - 242
File #6 TECH_RUNGS - 16
HIVAC 8 10 SECOND TIMER COMPLETE CR8FLT
T4:16
DN
[249]
PURGE TIME MONITOR CRYO 6 5 SEC TEST PGC6
GEQ
GRTR THAN OR EQUAL (A>=B)
SOURCE A: T4:26.ACC
0
SOURCE B: 5
5
T4:26.ACC - [114]
N2 FLOW SWITCH 6 NIFS6
I:036
17
PIRINI GUAGE 6 NO FAULT PGNF6
I:040
15

Rung #257

```
|                                                                                   CRYO RE-     |
|               PUMPDOWN                                                            GENERATION   |
|COMPRESSOR    AFTER CRYO                                                          FAULT        |
|7 REGEN-      REGEN                                                               COMPRESSOR   |
|ERATION       COMPRESSOR                                                          7            |
|PROGRAM       7  2 HOUR                                                           CRFLT7       |
|CYRGN7        PDM7                                                                   B3        |
|    B3          T4:47                                                                          |
|----] [--------+---] [------+------------------------------------------------------( )-------|
|   327         |     DN     |                                                        337       |
|[243]          |[222]       |                                                                  |
|               |            | B3/337 - ] [ - File #3 CRYO_REGEN - 243                          |
|               |            |                File #6 TECH_RUNGS - 16                           |
|               |HIVAC 9,10,11                                                                  |
|               |10 SEC      |                                                                  |
|               |TIMER       |                                                                  |
|               |COMPLETE    |                                                                  |
|               |CR91012FLT  |                                                                  |
|               |   T4:17    |                                                                  |
|               +----] [-----+                                                                  |
|               |    DN      |                                                                  |
|               |[250]       |                                                                  |
|               |PURGE TIME  |                                                                  |
|               |MONITOR                 N2 FLOW |                                              |
|               |CRYO 7                  SWITCH  |                                              |
|               |5 SEC TEST              7       |                                              |
|               |PGC7                    NIFS7   |                                              |
|               |+-GEQ-------------------+ I:052 |                                              |
|               ++GRTR THAN OR EQUAL (A>=B)+--]/[--+                                            |
|               ||SOURCE A:     T4:27.ACC|  00   |                                              |
|               ||                      0|       |                                              |
|               ||SOURCE B:             5|       |                                              |
|               ||                      5|       |                                              |
|               |+-----------------------+       |                                              |
|               |T4:27.ACC - [115]               |                                              |
|               |PIRINI                          |                                              |
|               |GUAGE 6                         |                                              |
|               |NO FAULT                        |                                              |
|               |PGNF6                           |                                              |
|               |  I:040                         |                                              |
|               +---]/[--------------------------+                                              |
|               |    15                          |                                              |
|               |PIRINI                          |                                              |
|               |GUAGE 8                         |                                              |
|               |NO FAULT                        |                                              |
|               |PGNF8                           |                                              |
|               |  I:054                         |                                              |
|               +---]/[--------------------------+                                              |
|                   15                                                                          |
```

Rung #258

```
                 PUMPDOWN                                                  CRYO RE-
 COMPRESSOR      AFTER CRYO                                                GENERATION
 8 REGEN-        REGEN                                                     FAULT
 ERATION         COMPRESSOR                                                COMPRESSOR
 PROGRAM         8  2 HOUR                                                 8
 CYRGN8          PDM8                                                      CRFLT8
     B3             T4:48                                                    B3
|---] [-------+-----] [-----+-------------------------------------------------( )---|
     328      |     DN      |                                                338
 [244]        | [223]       |
              |             | B3/338 - ] [ - File #3 CRYO_REGEN - 244
              |             |                File #6 TECH_RUNGS - 16
              | HIVAC 11    |
              | 10 SEC      |
              | TIMER       |
              | COMPLETE    |
              | CR11FLT     |
              |   T4:18     |
              |---] [-------+
              |     DN      |
              | [251]       |
              | PURGE TIME  |
              | MONITOR                     N2 FLOW
              | CRYO 8                      SWITCH
              | 5 SEC TEST                  8
              | PGC8                        NIFS8
              | +-GEQ---------------------+  I:052
              |-|GRTR THAN OR EQUAL (A>=B)|---]/[---+
              | |SOURCE A:     T4:28.ACC  |    13   |
              | |                      0  |         |
              | |SOURCE B:             5  |         |
              | |                      5  |         |
              | +-------------------------+         |
              | T4:28.ACC - [116]                   |
              | PIRINI                              |
              | GUAGE 8                             |
              | NO FAULT                            |
              | PGNF8                               |
              |  I:054                              |
              +---]/[-------------------------------+
                  15
```

573

Rung #259

```
| COMPRESSOR                                                        |
| 1 REGEN-                                                   REGEN- |
| ERATION                                                   ERATION |
| PROGRAM                                                    'OR'   |
| CYRGN1                                                    RGN_OR  |
|     B3                                                       B3   |
+-+--] [--+-------------------------------------------------( )----+
| |   321 |                                                   316   |
| |[25]   |                                                         |
| |       | B3/316 - ] [ - File #3 CRYO_REGEN - 260                 |
| |COMPRESSOR                                                       |
| |2 REGEN- |                                                       |
| |ERATION  |                                                       |
| |PROGRAM  |                                                       |
| |CYRGN2   |                                                       |
| |     B3  |                                                       |
| +---] [---+                                                       |
| |    322  |                                                       |
| |[238]    |                                                       |
| |COMPRESSOR                                                       |
| |3 REGEN- |                                                       |
| |ERATION  |                                                       |
| |PROGRAM  |                                                       |
| |CYRGN3   |                                                       |
| |     B3  |                                                       |
| +---] [---+                                                       |
|      323  |                                                       |
| |[239]    |                                                       |
| |COMPRESSOR                                                       |
| |4 REGEN- |                                                       |
| |ERATION  |                                                       |
| |PROGRAM  |                                                       |
| |CYRGN4   |                                                       |
| |     B3  |                                                       |
| +---] [---+                                                       |
| |    324  |                                                       |
| |[240]    |                                                       |
| |COMPRESSOR                                                       |
| |5 REGEN- |                                                       |
| |ERATION  |                                                       |
| |PROGRAM  |                                                       |
| |CYRGN5   |                                                       |
| |     B3  |                                                       |
| +---] [---+                                                       |
| |    325  |                                                       |
| |[241]    |                                                       |
| |COMPRESSOR                                                       |
| |6 REGEN- |                                                       |
|   ERATION |                                                       |
| |PROGRAM  |                                                       |
| |CYRGN6   |                                                       |
| |     B3  |                                                       |
| +---] [---+                                                       |
| |    326  |                                                       |
| |[242]    |                                                       |
| |COMPRESSOR                                                       |
| |7 REGEN- |                                                       |
| |ERATION  |                                                       |
| |PROGRAM  |                                                       |
| |CYRGN7   |                                                       |
| |     B3  |                                                       |
| +---] [---+                                                       |
> >         >                                                       >
```

```
< <            <
| |   327      |
| |[243]       |
| |COMPRESSOR  |
| |8 REGEN-    |
| |ERATION     |
| |PROGRAM     |
| |CYRGN8      |
| |    B3      |
| +----] [-----+
|     328
| [244]
Rung #260
|          ENABLE      ENABLE      ENABLE      ENABLE      ENABLE      ENABLE      ENABLE      ENABLE
|REGEN-    CRYO        CRYO        CRYO        CRYO        CRYO        CRYO        CRYO        CRYO
|ERATION   COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COOL DOWN MODE
|"OR"      1           2           3           4           5           6           7           8           MP2 OFF DELAY
|RGN_OR    CY1         CY2         CY3         CY4         CY5         CY6         CY7         CY8         CD_MP2OFF
|  B3      O:010       O:010       O:030       O:030       O:044       O:044       O:060       O:060       +-TON--------------+
+--] [-----] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------+TIMER ON DELAY    +-(EN)-
|  316       04          05          04          05          04          05          04          05        |TIMER:       T4:79|
| [259]    [6]         [81]        [82]        [83]        [84]        [85]        [86]        [87]        |BASE (SEC):    1.0+-(DN)
|                                                                                                          |PRESET:       3600|
|                                                                                                          |ACCUM:           0|
|                                                                                                          +------------------+
T4:79.DN - ] [ - File #3 CRYO_REGEN - 261
Rung #261
|          DWELL 2     DWELL 4   DWELL 5
|          CHAMBER     CHAMBER   CHAMBER                                                     CRYO REGEN
|          ROUGH       ROUGH     ROUGH                                                       MECH PUMP AND
|          VALVE RV2   VALVE     VALVE                                                       BLOWER 2
|          CLOSED      CLOSED    CLOSED                                                      DISABLE
|CD_MP2OFF RVS3        RVS5      RVS7                                                        CRMPBL2D
|  T4:79     I:022      I:036     I:052                                                      +-TON--------------+
+--] [-------] [--------] [-------] [--------------------------------------------------------+TIMER ON DELAY    +-(EN)-
|   DN        15         15        14                                                        |TIMER:      T4:170|
| [260]                                                                                      |BASE (SEC):   0.01+-(DN)
|                                                                                            |PRESET:        100|
|                                                                                            |ACCUM:           0|
|                                                                                            +------------------+
T4:170.TT - ] [ - File #2 MAIN_PRGRM - 91
```

Rung #262

PURGE TIME MONITOR CRYO 1 60 MIN DONE PGC1
T4:21
DN
[9]

T4:130.TT - -| |- - File #2 MAIN_PRGRM - 73

PURGE TIME MONITOR CRYO 2 120 MIN. DONE PGC2
T4:22
DN
[110]

PURGE TIME MONITOR CRYO 3 120 MIN. DONE PGC3
T4:23
DN
[111]

PURGE TIME MONITOR CRYO 4 120 MIN DONE PGC4
T4:24
DN
[112]

PURGE TIME MONITOR CRYO 5 120 MIN DONE PGC5
T4:25
DN
[113]

PURGE TIME MONITOR CRYO 6 120 MIN DONE PGC6
T4:26
DN
[114]

PURGE TIME
> > >

PURGE COMPLETE
PRGDONE
TON
TIMER ON DELAY (EN)
TIMER: T4:130
BASE (SEC): 1.0 (DN)
PRESET: 10
ACCUM: 0

>

```
< <              <
| |MONITOR       |
| |CRYO 7        |
| |120 MIN       |
| |DONE          |
| |PGC7          |
| |    T4:27     |
| |-----| |------|
| |      DN      |
| |[115]         |
| |PURGE TIME    |
| |MONITOR       |
| |CRYO 8        |
| |120 MIN       |
| |DONE          |
| |PGC8          |
| |    T4:28     |
| |-----| |------|
|        DN
|  [116]
```

Rung #263

```
 S_TRAP_1                                                        SIEVE TRAP
  T4:341                                                         MECH PUMP
──┤ ├──────────────────────────────────────────────────────────  ENABLE
     TT                                                          SVMPEN
 [1]                                                               B3
                                                                ─( )─
 S_TRAP_2      B3/125 - ┤ ├ - File #2 MAIN_PRGRM - 73              125
  T4:342
──┤ ├──
     TT
 [35]
 S_TRAP_3
  T4:343
──┤ ├──
     TT
 [39]
 S_TRAP_4
  T4:344
──┤ ├──
     TT
 [43]
 S_TRAP_5
  T4:345
──┤ ├──
     TT
 [47]
 S_TRAP_6
  T4:346
──┤ ├──
     TT
 [54]
 S_TRAP_7
  T4:347
──┤ ├──
     TT
 [58]
 S_TRAP_8
  T4:348
──┤ ├──
     TT
 [64]
```

Rung #264

```
                                                                      SIEVE MECHANICA              SIEVE TRAP
                                                                      PUMP DISABLE                 MECH PUMP
                                                                      PULSE                        DISABLE
 TRAP_1  S_TRAP_2  S_TRAP_3  S_TRAP_4  S_TRAP_5  S_TRAP_6  S_TRAP_7  S_TRAP_8  SMPDP                SVMPDIS
 T4:341   T4:342    T4:343    T4:344    T4:345    T4:346    T4:347    T4:348      B3                    B3
──┤/├──────┤/├───────┤/├───────┤/├───────┤/├───────┤/├───────┤/├───────┤/├──────[ONS]──────────────────( )──
   TT        TT        TT        TT        TT        TT        TT        TT        175                   102
 [1]       [35]      [39]      [43]      [47]      [54]      [58]      [64]
B3/102 - ┤ ├ - File #2 MAIN_PRGRM - 91
       -( )- - File #3 CRYO_REGEN - 264
```

Rung #265

```
                                                      RETURN FROM
                                                      RETURN CONVEYOR
                                                      TO MAIN PROGRAM
                                                      RTN_MAIN
                                                      ┌─RET──────────┐
──────────────────────────────────────────────────────┤RETURN ()     ├─
>                                                     >>>>>>>>>>>>>>>>> >
```

<<<<<<<<<<<<<<<<<<< <

Rung #266 [END]

Rung #000

```
|AUTO RETURN  RETURN CONVEYOR  PALETTE READY  RETURN CONVEYOR  RETURN CONVEYOR              RETURN CONVEYOR |
|CONVEYOR     MANUAL ON        AT ROBOT       GATE             SENSOR 1                     MOTOR 1         |
|AUTO_RC      RCMAN_ON         PAL_RDY        RC_GATE          RCS1                         RCM1            |
|   B3          I:066            I:065          B3               I:065                        O:073         |
|---] [---------]/[--------+-----] [------------]/[--------------]/[------+--------------------(L)---------|
|   700          07        |     00            701               01     |                     00          |
|                          |                  [3]                        |                                 |
|                          |RETURN CONVEYOR  RETURN CONVEYOR             |                                 |
|                          |SENSOR 1         SENSOR 2                    |                                 |
|                          |RCS1             RCS2                        |                                 |
|                          |    I:065          I:065                     |                                 |
|                          +-----] [------------]/[----------------------+                                 |
|                                01             02                                                         |
O:073/00 - ] [ - File #4 RETRN_CNVR -  1,3
         -(L)- - File #4 RETRN_CNVR -  0
         -(U)- - File #4 RETRN_CNVR -  2
```

Rung #001

```
|RETURN CONVEYOR                                              RETURN CONVEYOR          |
|MOTOR 1                                                      MOTOR 1 TIMER            |
|RCM1                                                         RCM1_TMR                 |
|    O:073                                                    +--TON-------------+     |
|-----] [-----------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|      00                                                     |TIMER:    T4:351  |     |
|[0]                                                          |BASE (SEC):  1.0  +-(DN) |
|                                                             |PRESET:        25 |     |
|                                                             |ACCUM:          0 |     |
|                                                             +------------------+     |
T4:351.DN - ] [ - File #4 RETRN_CNVR -  2
```

Rung #002

```
|        RETURN CONVEYOR     RETURN CONVEYOR                              RETURN CONVEYOR |
|        SENSOR 1            MOTOR 1 SS                                   MOTOR 1         |
|        RCS1                RCM1SS                                       RCM1            |
|            I:065              B3                                          O:073        |
|-+-+-+-+----] [------+--------[ONS]--------+-+----------------------------(U)----------|
| | | |         01    |        350          | |                             00          |
| | | |               |                     | | O:073/00 - ] [ - File #4 RETRN_CNVR - 1, 3 |
| | | |               |                     | |           -(L)- - File #4 RETRN_CNVR - 0  |
| | | |RETURN CONVEYOR|                     | |                                         |
| | | |SENSOR 2       |                     | |                                         |
| | | |RCS2           |                     | |                                         |
| | | |    I:065      |                     | |                                         |
| | | +-----] [-------+                     | |                                         |
| | |         02                            | |                                         |
| | |RETURN CONVEYOR  RETURN CONVEYOR       | |                                         |
| | |SENSOR 1         SENSOR 2              | |                                         |
| | |RCS1             RCS2                  | |                                         |
| | |    I:065          I:065               | |                                         |
| | +-----] [-----------] [-----------------+ |                                         |
| |        01            02                   |                                         |
| |RCM1_TMR                                   |                                         |
| | T4:351                                    |                                         |
| +---] [-------------------------------------+                                         |
|      DN                                                                               |
| [1]                                                                                   |
```

Rung #003

```
|RETURN CONVEYOR                                                       RETURN CONVEYOR |
|MOTOR 1                                                               GATE            |
|RCM1                                                                  RC_GATE         |
|    O:073                                                               B3            |
|-----] [----------------------------------------------------------------(L)----------|
|      00                                                                701           |
|[2]                                                                                   |
```

```
B3/701 - -| |- - File #4 RETRN_CNVR - 4
         -|/|- - File #4 RETRN_CNVR - 0
         -(L)- - File #4 RETRN_CNVR - 3
         -(U)- - File #4 RETRN_CNVR - 5
```

Rung #004

```
|RETURN CONVEYOR                                      RETURN CONVEYOR       |
|GATE                                                 GATE TIMER            |
|RC_GATE                                              RC_GATE_TMRA          |
|       B3                                            +-TON-----------+     |
|------| |--------------------------------------------|TIMER ON DELAY |-(EN)-|
|      701                                            |TIMER:  T4:350 |     |
|[3]                                                  |BASE (SEC): 1.0|-(DN)|
|                                                     |PRESET:      25|     |
|                                                     |ACCUM:        0|     |
|                                                     +---------------+     |
T4:350.DN - -| |- - File #4 RETRN_CNVR - 5
```

Rung #005

```
|                                                        RETURN CONVEYOR |
|                                                        GATE            |
|RC_GATE_TMRA                                            RC_GATE         |
|   T4:350                                                  B3           |
|------| |--------------------------------------------------(U)----------|
|      DN                                                   701          |
|[4]                                                                     |
B3/701 - -| |- - File #4 RETRN_CNVR - 4
         -|/|- - File #4 RETRN_CNVR - 0
         -(L)- - File #4 RETRN_CNVR - 3
         -(U)- - File #4 RETRN_CNVR - 5
```

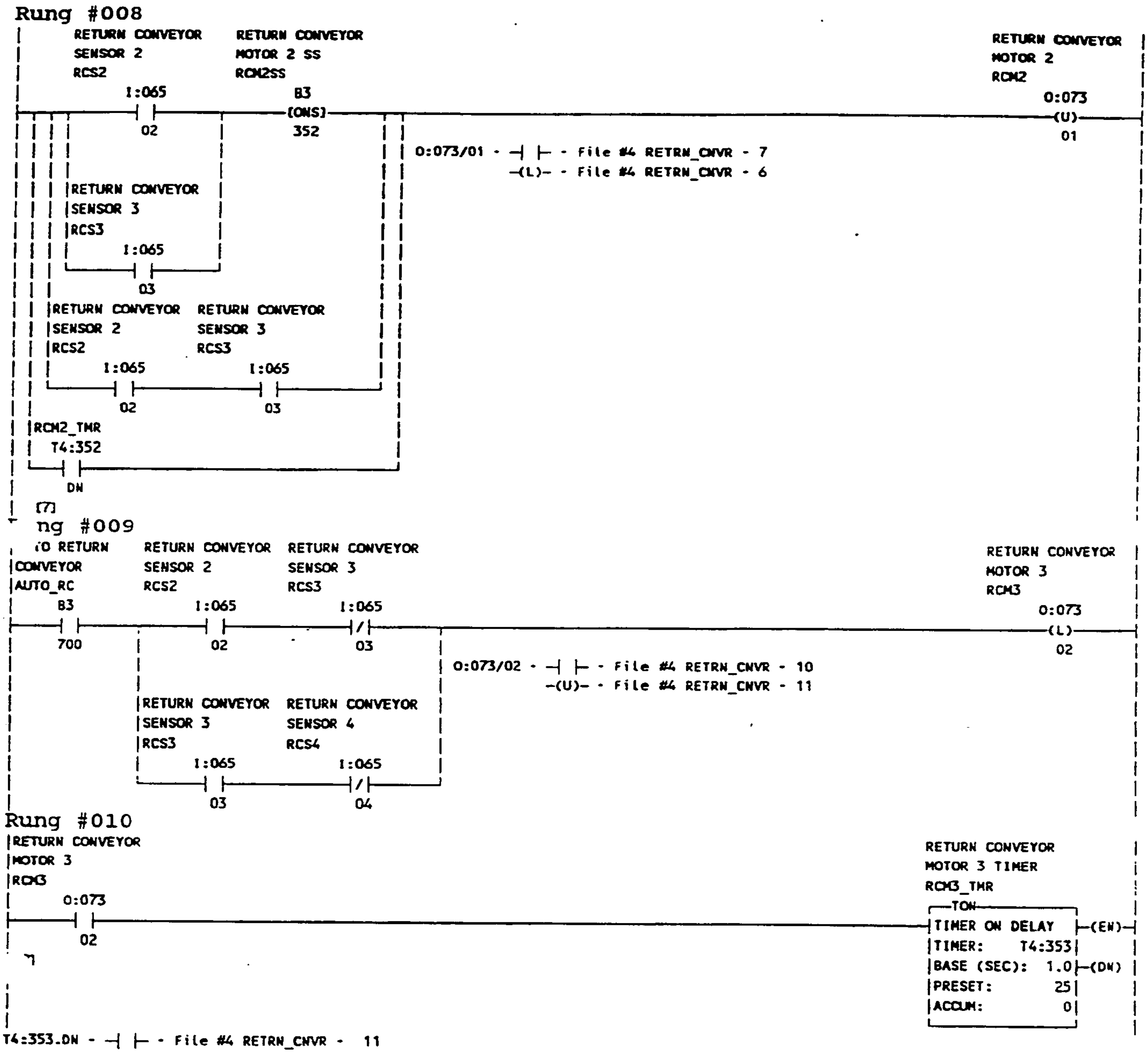
Rung #006

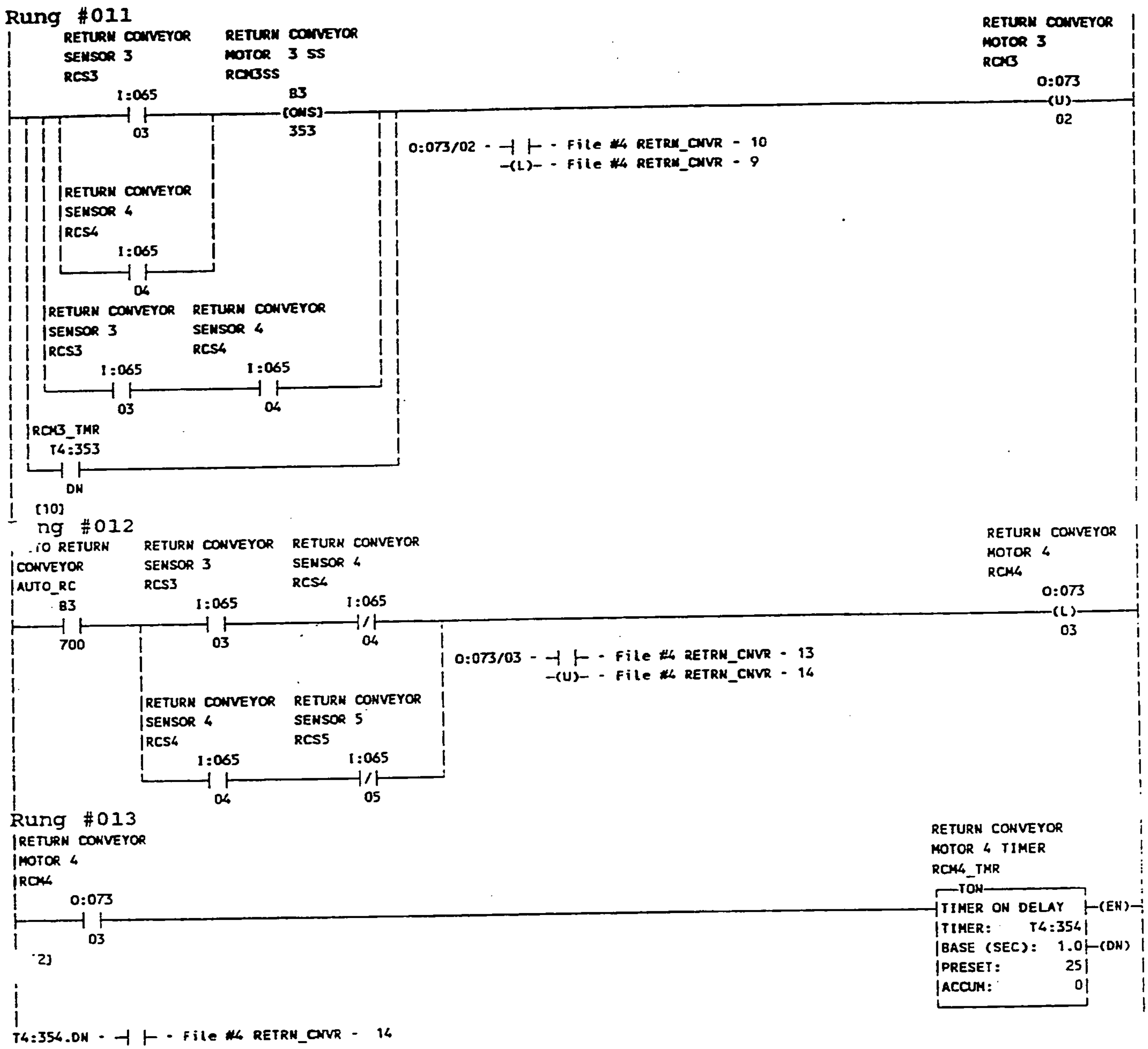
```
|AUTO RETURN   RETURN CONVEYOR  RETURN CONVEYOR                RETURN CONVEYOR |
|CONVEYOR      SENSOR 1         SENSOR 2                       MOTOR 2         |
|AUTO_RC       RCS1             RCS2                           RCM2            |
|    B3            I:065          I:065                           O:073        |
|---| |-----+------| |------------|/|------+-----------------------(L)---------|
|   700     |       01             02     |                         01         |
|           |                             | O:073/01 - -| |- - File #4 RETRN_CNVR - 7
|           |                             |            -(U)- - File #4 RETRN_CNVR - 8
|           |RETURN CONVEYOR  RETURN CONVEYOR|                                 |
|           |SENSOR 2         SENSOR 3       |                                 |
|           |RCS2             RCS3           |                                 |
|           |      I:065          I:065      |                                 |
|           +------| |------------|/|-------+                                 |
|                   02             03                                        |
```

Rung #007

```
|RETURN CONVEYOR                                      RETURN CONVEYOR       |
|MOTOR 2                                              MOTOR 2 TIMER         |
|RCM2                                                 RCM2_TMR              |
|     O:073                                           +-TON-----------+     |
|------| |--------------------------------------------|TIMER ON DELAY |-(EN)-|
|       01                                            |TIMER:  T4:352 |     |
|[6]                                                  |BASE (SEC): 1.0|-(DN)|
|                                                     |PRESET:      25|     |
|                                                     |ACCUM:        0|     |
|                                                     +---------------+     |
T4:352.DN - -| |- - File #4 RETRN_CNVR - 8
```

581


Rung #008
RETURN CONVEYOR SENSOR 2 RCS2
I:065
02
RETURN CONVEYOR MOTOR 2 SS RCM2SS
B3
[ONS]
352
RETURN CONVEYOR MOTOR 2 RCM2
O:073
(U)
01
O:073/01 - ┤ ├ - File #4 RETRN_CNVR - 7
-(L)- - File #4 RETRN_CNVR - 6
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 2 RCS2
I:065
02
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RCM2_TMR
T4:352
DN
[7]
ng #009
(O RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 2 RCS2
I:065
02
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR MOTOR 3 RCM3
O:073
(L)
02
O:073/02 - ┤ ├ - File #4 RETRN_CNVR - 10
-(U)- - File #4 RETRN_CNVR - 11
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
Rung #010
RETURN CONVEYOR MOTOR 3 RCM3
O:073
02
RETURN CONVEYOR MOTOR 3 TIMER RCM3_TMR
TON
TIMER ON DELAY
TIMER: T4:353
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:353.DN - ┤ ├ - File #4 RETRN_CNVR - 11


Rung #011
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR MOTOR 3 SS RCM3SS
B3
[ONS]
353
RETURN CONVEYOR MOTOR 3 RCM3
O:073
(U)
02
O:073/02 - ┤├ - File #4 RETRN_CNVR - 10
-(L)- - File #4 RETRN_CNVR - 9
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RCM3_TMR
T4:353
DN
[10]
ng #012
.TO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RETURN CONVEYOR MOTOR 4 RCM4
O:073
(L)
03
O:073/03 - ┤├ - File #4 RETRN_CNVR - 13
-(U)- - File #4 RETRN_CNVR - 14
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RETURN CONVEYOR SENSOR 5 RCS5
I:065
05
Rung #013
RETURN CONVEYOR MOTOR 4 RCM4
O:073
03
2]
RETURN CONVEYOR MOTOR 4 TIMER RCM4_TMR
TON
TIMER ON DELAY
TIMER: T4:354
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:354.DN - ┤├ - File #4 RETRN_CNVR - 14

583

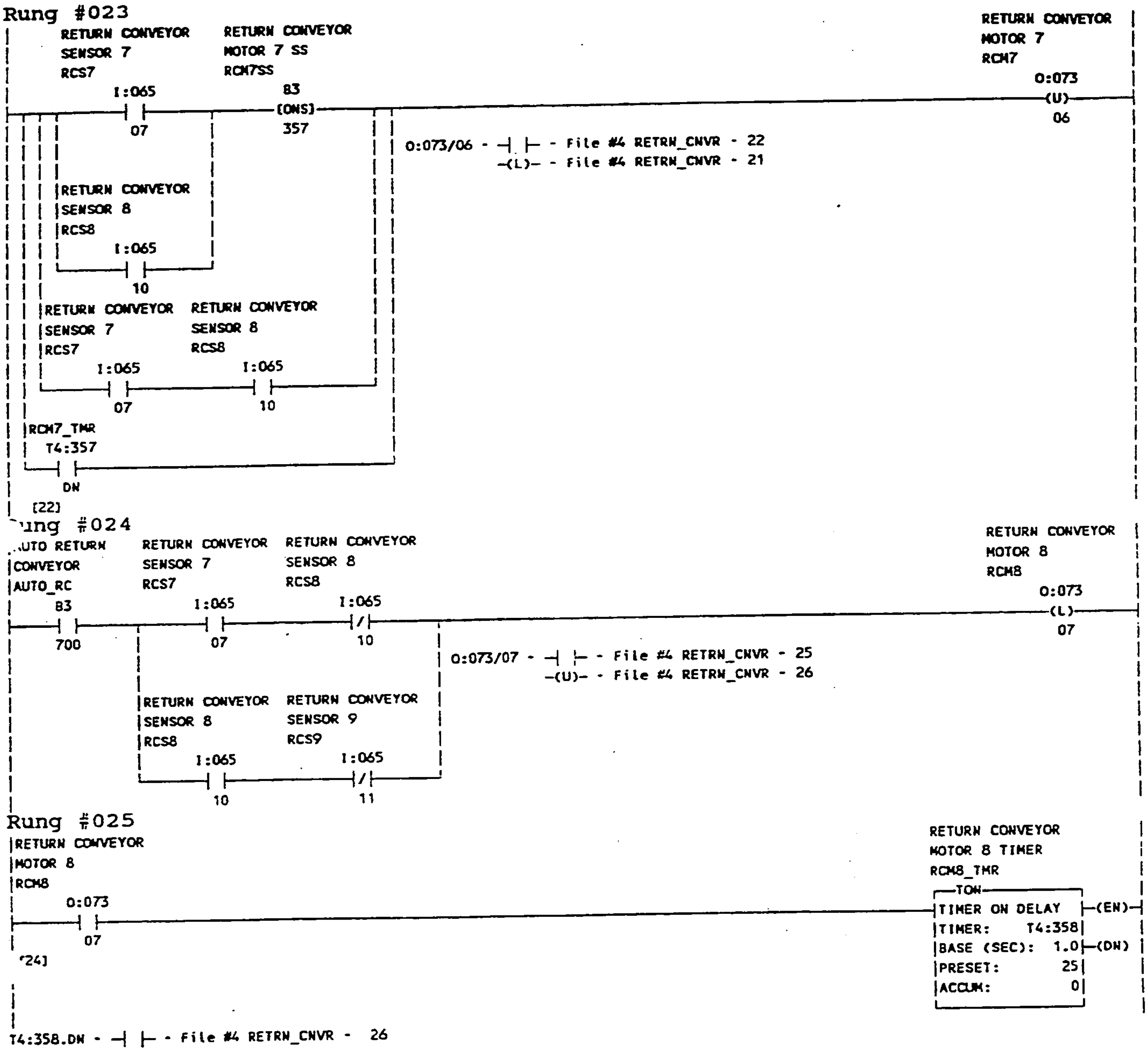
```
Rung #014
|    RETURN CONVEYOR    RETURN CONVEYOR                                RETURN CONVEYOR |
|    SENSOR 4           MOTOR 4 SS                                     MOTOR 4         |
|    RCS4               RCM4SS                                         RCM4            |
|         I:065            B3                                             O:073        |
|-+-+-+-+----| |----+-----[ONS]----+-+--------------------------------------(U)--------|
| | | | |    04     |      354      | |                                      03         |
| | | | |           |               | | O:073/03 - -| |- - File #4 RETRN_CNVR - 13    |
| | | | |           |               | |      -(L)- - File #4 RETRN_CNVR - 12           |
| | | | |RETURN CONVEYOR            | |                                                |
| | | | |SENSOR 5   |               | |                                                |
| | | | |RCS5       |               | |                                                |
| | | | |    I:065  |               | |                                                |
| | | | +-----| |---+               | |                                                |
| | | |       05                    | |                                                |
| | | |RETURN CONVEYOR  RETURN CONVEYOR |                                              |
| | | |SENSOR 4         SENSOR 5    | |                                                |
| | | |RCS4             RCS5        | |                                                |
| | | |    I:065            I:065   | |                                                |
| | | +-----| |--------------| |----+ |                                                |
| | |       04              05        |                                                |
| | |RCM4_TMR                         |                                                |
| | |  T4:354                         |                                                |
| | +----| |------------------------- +                                                |
|        DN
|  [13]
Rung #015
  O RETURN       RETURN CONVEYOR  RETURN CONVEYOR                      RETURN CONVEYOR
|CONVEYOR        SENSOR 4         SENSOR 5                             MOTOR 5
|AUTO_RC         RCS4             RCS5                                 RCM5
|   B3              I:065            I:065                               O:073
|----| |-----+--------| |--------------|/|----+----------------------------(L)-------
|   700      |        04               05     |                           04
|            |                                | O:073/04 - -| |- - File #4 RETRN_CNVR - 16
|            |                                |      -(U)- - File #4 RETRN_CNVR - 17
|            |RETURN CONVEYOR  RETURN CONVEYOR|
|            |SENSOR 5         SENSOR 6       |
|            |RCS5             RCS6           |
|            |      I:065            I:065    |
|            +--------| |--------------|/|----+
|                     05               06
Rung #016
|RETURN CONVEYOR                                          RETURN CONVEYOR
|MOTOR 5                                                  MOTOR 5 TIMER
|RCM5                                                     RCM5_THR
|       O:073                                             +--TON-------------+
|--------| |----------------------------------------------|TIMER ON DELAY    |-(EN)-
|          04                                             |TIMER:     T4:355 |
| [15]                                                    |BASE (SEC):   1.0 |-(DN)
|                                                         |PRESET:        25 |
|                                                         |ACCUM:          0 |
|                                                         +------------------+

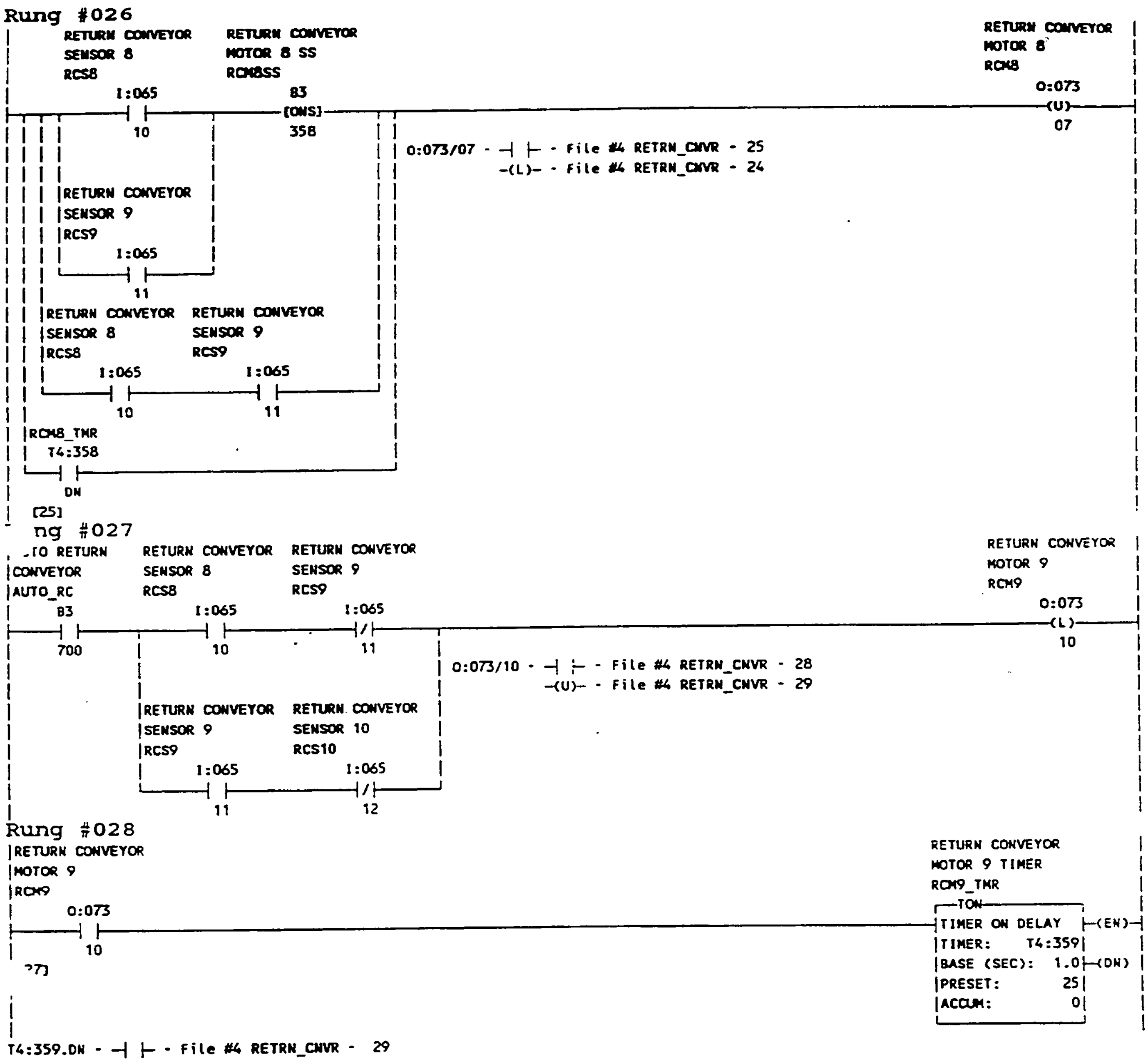
T4:355.DN - -| |- - File #4 RETRN_CNVR - 17
```

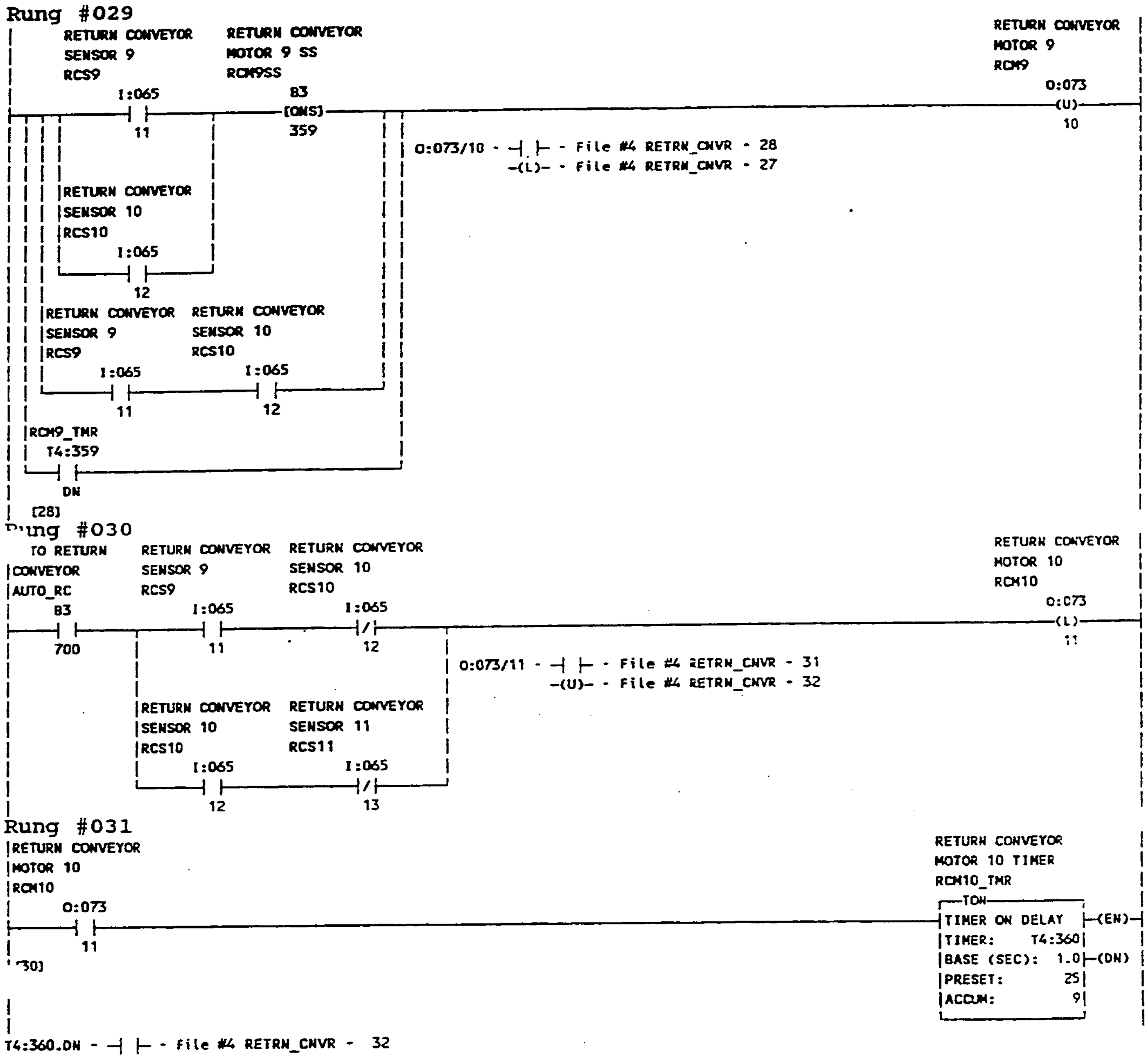
```
Rung #017
RETURN CONVEYOR      RETURN CONVEYOR                              RETURN CONVEYOR
SENSOR 5             MOTOR 5 SS                                   MOTOR 5
RCS5                 RCM5SS                                       RCM5
        I:065                B3                                       O:073
---------| |-----------------[ONS]-------------------------------------(U)---
          05                 355                                        04
                                   O:073/04 - -| |- - File #4 RETRN_CNVR - 16
                                            -(L)- - File #4 RETRN_CNVR - 15
RETURN CONVEYOR
SENSOR 6
RCS6
        I:065
---------| |---
          06
RETURN CONVEYOR    RETURN CONVEYOR
SENSOR 5           SENSOR 6
RCS5               RCS6
      I:065              I:065
--------| |----------------| |---
         05                 06
RCM5_TMR
 T4:355
---| |---
    DN
[16]
Rung #018
.O RETURN      RETURN CONVEYOR   RETURN CONVEYOR                  RETURN CONVEYOR
CONVEYOR       SENSOR 5          SENSOR 6                         MOTOR 6
AUTO_RC        RCS5              RCS6                             RCM6
  B3                I:065             I:065                           O:073
---| |------------------| |---------------|/|--------------------------(L)---
  700                   05                06                              05
                                   O:073/05 - -| |- - File #4 RETRN_CNVR - 19
                                            -(U)- - File #4 RETRN_CNVR - 20
               RETURN CONVEYOR   RETURN CONVEYOR
               SENSOR 6          SENSOR 7
               RCS6              RCS7
                    I:065             I:065
               ---------| |---------------|/|---
                        06                07
Rung #019
RETURN CONVEYOR                                         RETURN CONVEYOR
MOTOR 6                                                 MOTOR 6 TIMER
RCM6                                                    RCM6_TMR
    O:073                                               +-TON---------------+
-----| |------------------------------------------------|TIMER ON DELAY     |-(EN)-
     05                                                 |TIMER:      T4:356|
[18]                                                    |BASE (SEC):    1.0|-(DN)
                                                        |PRESET:         25|
                                                        |ACCUM:           0|
                                                        +-------------------+
T4:356.DN - -| |- - File #4 RETRN_CNVR - 20
```

585

```
Rung #020
|     RETURN CONVEYOR     RETURN CONVEYOR                                          RETURN CONVEYOR |
|     SENSOR 6            MOTOR 6 SS                                               MOTOR 6         |
|     RCS6                RCM6SS                                                   RCM6            |
|          I:065                B3                                                     O:073      |
|-+-+-+-+----] [------------+---[ONS]----+-+-----------------------------------------(U)--------|
| | | | |       06          |    356     | |                                           05        |
| | | | |                   |            | | O:073/05 - ] [ - File #4 RETRN_CNVR - 19            |
| | | | |                   |            | |            -(L)- - File #4 RETRN_CNVR - 18          |
| | | | |RETURN CONVEYOR    |            | |                                                     |
| | | | |SENSOR 7           |            | |                                                     |
| | | | |RCS7               |            | |                                                     |
| | | | |      I:065        |            | |                                                     |
| | | | +------] [----------+            | |                                                     |
| | | |          07                      | |                                                     |
| | | |RETURN CONVEYOR  RETURN CONVEYOR  | |                                                     |
| | | |SENSOR 6         SENSOR 7         | |                                                     |
| | | |RCS6             RCS7             | |                                                     |
| | | |    I:065           I:065         | |                                                     |
| | | +-----] [-------------] [----------+ |                                                     |
| | |        06              07            |                                                     |
| | |RCM6_TMR                              |                                                     |
| | | T4:356                               |                                                     |
| | +--] [---------------------------------+                                                     |
|        DN                                                                                      |
|  [19]                                                                                          |
Rung #021
|AUTO RETURN    RETURN CONVEYOR   RETURN CONVEYOR                                RETURN CONVEYOR |
|CONVEYOR       SENSOR 6          SENSOR 7                                       MOTOR 7         |
|AUTO_RC        RCS6              RCS7                                           RCM7            |
|   B3               I:065             I:065                                         O:073       |
|---] [-------+------] [--------------]/[------+------------------------------------(L)---------|
|   700       |       06                 07    |                                     06          |
|             |                                | O:073/06 - ] [ - File #4 RETRN_CNVR - 22      |
|             |                                |            -(U)- - File #4 RETRN_CNVR - 23    |
|             |RETURN CONVEYOR   RETURN CONVEYOR|                                              |
|             |SENSOR 7          SENSOR 8       |                                              |
|             |RCS7              RCS8           |                                              |
|             |      I:065             I:065    |                                              |
|             +------] [--------------]/[------+                                              |
|                     07                10                                                     |
Rung #022
|RETURN CONVEYOR                                                      RETURN CONVEYOR          |
|MOTOR 7                                                              MOTOR 7 TIMER            |
|RCM7                                                                 RCM7_TMR                 |
|    O:073                                                            +-TON--------------+     |
|-----] [-------------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|      06                                                             |TIMER:     T4:357 |     |
| [21]                                                                |BASE (SEC):   1.0 +-(DN)|
|                                                                     |PRESET:        25 |     |
|                                                                     |ACCUM:          0 |     |
|                                                                     +------------------+     |
T4:357.DN - ] [ - File #4 RETRN_CNVR - 23
```


Rung #023
RETURN CONVEYOR SENSOR 7 RCS7
RETURN CONVEYOR MOTOR 7 SS RCM7SS
I:065 07
B3 [ONS] 357
RETURN CONVEYOR MOTOR 7 RCM7
O:073 (U) 06
O:073/06 - ┤ ├ - File #4 RETRN_CNVR - 22
-(L)- - File #4 RETRN_CNVR - 21
RETURN CONVEYOR SENSOR 8 RCS8
I:065 10
RETURN CONVEYOR SENSOR 7 RCS7
RETURN CONVEYOR SENSOR 8 RCS8
I:065 07
I:065 10
RCM7_TMR T4:357 DN
[22]
Rung #024
AUTO RETURN CONVEYOR AUTO_RC
RETURN CONVEYOR SENSOR 7 RCS7
RETURN CONVEYOR SENSOR 8 RCS8
RETURN CONVEYOR MOTOR 8 RCM8
B3 700
I:065 07
I:065 10
O:073 (L) 07
O:073/07 - ┤ ├ - File #4 RETRN_CNVR - 25
-(U)- - File #4 RETRN_CNVR - 26
RETURN CONVEYOR SENSOR 8 RCS8
RETURN CONVEYOR SENSOR 9 RCS9
I:065 10
I:065 11
Rung #025
RETURN CONVEYOR MOTOR 8 RCM8
O:073 07
RETURN CONVEYOR MOTOR 8 TIMER RCM8_TMR
TON
TIMER ON DELAY (EN)
TIMER: T4:358
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0
[24]
T4:358.DN - ┤ ├ - File #4 RETRN_CNVR - 26


Rung #026
RETURN CONVEYOR SENSOR 8 RCS8
I:065
10
RETURN CONVEYOR MOTOR 8 SS RCM8SS
B3
[ONS]
358
RETURN CONVEYOR MOTOR 8 RCM8
O:073
(U)
07
O:073/07 - ⊣ ⊢ - File #4 RETRN_CNVR - 25
-(L)- - File #4 RETRN_CNVR - 24
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 8 RCS8
I:065
10
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RCM8_TMR
T4:358
DN
[25]
Rung #027
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 8 RCS8
I:065
10
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR MOTOR 9 RCM9
O:073
(L)
10
O:073/10 - ⊣ ⊢ - File #4 RETRN_CNVR - 28
-(U)- - File #4 RETRN_CNVR - 29
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
Rung #028
RETURN CONVEYOR MOTOR 9 RCM9
O:073
10
RETURN CONVEYOR MOTOR 9 TIMER RCM9_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:359
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 0
T4:359.DN - ⊣ ⊢ - File #4 RETRN_CNVR - 29


Rung #029
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR MOTOR 9 SS RCM9SS
B3
[ONS]
359
RETURN CONVEYOR MOTOR 9 RCM9
O:073
(U)
10
O:073/10 - ┤ ├ - File #4 RETRN_CNVR - 28
-(L)- - File #4 RETRN_CNVR - 27
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RCM9_TMR
T4:359
DN
[28]
Rung #030
TO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RETURN CONVEYOR MOTOR 10 RCM10
O:073
(L)
11
O:073/11 - ┤ ├ - File #4 RETRN_CNVR - 31
-(U)- - File #4 RETRN_CNVR - 32
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RETURN CONVEYOR SENSOR 11 RCS11
I:065
13
Rung #031
RETURN CONVEYOR MOTOR 10 RCM10
O:073
11
[30]
RETURN CONVEYOR MOTOR 10 TIMER RCM10_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:360
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 9
T4:360.DN - ┤ ├ - File #4 RETRN_CNVR - 32

```
Rung #032
      RETURN CONVEYOR   RETURN CONVEYOR                                      RETURN CONVEYOR
      SENSOR 10         MOTOR 10 SS                                          MOTOR 10
      RCS10             RCM10SS                                              RCM10
         I:065              B3                                                   O:073
|--------| |--------+-----[ONS]----+-------------------------------------------(U)----|
         12         |      360     |                                               11
                                    | O:073/11 - -| |- - File #4 RETRN_CNVR - 31
                                    |          -(L)- - File #4 RETRN_CNVR - 30
      |RETURN CONVEYOR |
      |SENSOR 11       |
      |RCS11           |
      |   I:065        |
      |----| |---------|
           13
    |RETURN CONVEYOR  RETURN CONVEYOR |
    |SENSOR 10        SENSOR 11       |
    |RCS10            RCS11           |
    |   I:065            I:065        |
    |----| |--------------| |---------|
         12               13
  |RCM10_TMR
  |  T4:360
  |----| |----------------------------|
        DN
  [31]
Rung #033
|AUTO RETURN     RETURN CONVEYOR   RETURN CONVEYOR                         RETURN CONVEYOR
|CONVEYOR        SENSOR 10         SENSOR 11                               MOTOR 11
|AUTO_RC         RCS10             RCS11                                   RCM11
   B3                I:065             I:065                                   O:073
|---| |------+--------| |---------------|/|----+-------------------------------(L)----|
   700       |        12                13     |                                  12
             |                                 | O:073/12 - -| |- - File #4 RETRN_CNVR - 34
             |                                 |          -(U)- - File #4 RETRN_CNVR - 35
             |RETURN CONVEYOR   RETURN CONVEYOR|
             |SENSOR 11         SENSOR 12      |
             |RCS11             RCS12          |
             |    I:065             I:065      |
             |-----| |---------------|/|-------|
                   13                14
Rung #034
|RETURN CONVEYOR                                                 RETURN CONVEYOR
|MOTOR 11                                                        MOTOR 11 TIMER
|RCM11          RCM11_TMR                                        RCM11_TMR
|   O:073         T4:361                                         +--TON-----------+
|----| |-----------|/|-------------------------------------------|TIMER ON DELAY  |-(EN)-|
|     12            DN                                           |TIMER:    T4:361|
 [33]             [34]                                           |BASE (SEC): 1.0 |-(DN)
|                                                                |PRESET:       25|
|                                                                |ACCUM:         1|
|                                                                +----------------+
T4:361.DN - -| |- - File #4 RETRN_CNVR - 35
            -|/|- - File #4 RETRN_CNVR - 34
```

```
Rung #035
     RETURN CONVEYOR      RETURN CONVEYOR                                    RETURN CONVEYOR
     SENSOR 11            MOTOR 11 SS                                        MOTOR 11
     RCS11                RCM11SS                                            RCM11
           I:065               B3                                              O:073
|------| |---------+------[ONS]---+--------------------------------------------(U)----|
           13      |           361 |                                             12
|                  |               | O:073/12 - -| |- - File #4 RETRN_CNVR - 34
|                  |               |           -(L)- - File #4 RETRN_CNVR - 33
|  |RETURN CONVEYOR|
|  |SENSOR 12      |
|  |RCS12          |
|  |      I:065    |
|  +-------| |-----+
|           14
| |RETURN CONVEYOR   RETURN CONVEYOR
| |SENSOR 11         SENSOR 12
| |RCS11             RCS12
| |      I:065             I:065
| +-------| |--------------| |-------+
|          13                14
|RCM11_TMR
|  T4:361
+-----| |---------------------------+
       DN
  [34]
Rung #036
AUTO RETURN     RETURN CONVEYOR   RETURN CONVEYOR                            RETURN CONVEYOR
CONVEYOR        SENSOR 11         SENSOR 12                                  MOTOR 12
AUTO_RC         RCS11             RCS12                                      RCM12
   B3                I:065             I:065                                   O:073
|----| |-------+-------| |---------------|/|-----+-----------------------------(L)----|
    700        |        13               14      |                               13
|              |                                 | O:073/13 - -| |- - File #4 RETRN_CNVR - 37
|              |                                 |           -(U)- - File #4 RETRN_CNVR - 38
|              |RETURN CONVEYOR   RETURN CONVEYOR|
|              |SENSOR 12         SENSOR 13      |
|              |RCS12             RCS13          |
|              |      I:065             I:065    |
|              +-------| |---------------|/|-----+
|                       14                15
Rung #037
|RETURN CONVEYOR                                                   RETURN CONVEYOR
|MOTOR 12                                                          MOTOR 12 TIMER
|RCM12           RCM12_TMR                                         RCM12_TMR
|      O:073      T4:362                                           +--TON-----------+
|-------| |---------|/|--------------------------------------------|TIMER ON DELAY  |-(EN)-
|        13          DN                                            |TIMER:    T4:362|
  [36]             [37]                                            |BASE (SEC):  1.0|-(DN)
|                                                                  |PRESET:       25|
|                                                                  |ACCUM:         0|
|                                                                  +----------------+
T4:362.DN - -| |- - File #4 RETRN_CNVR - 38
            -|/|- - File #4 RETRN_CNVR - 37
```

591

Rung #038

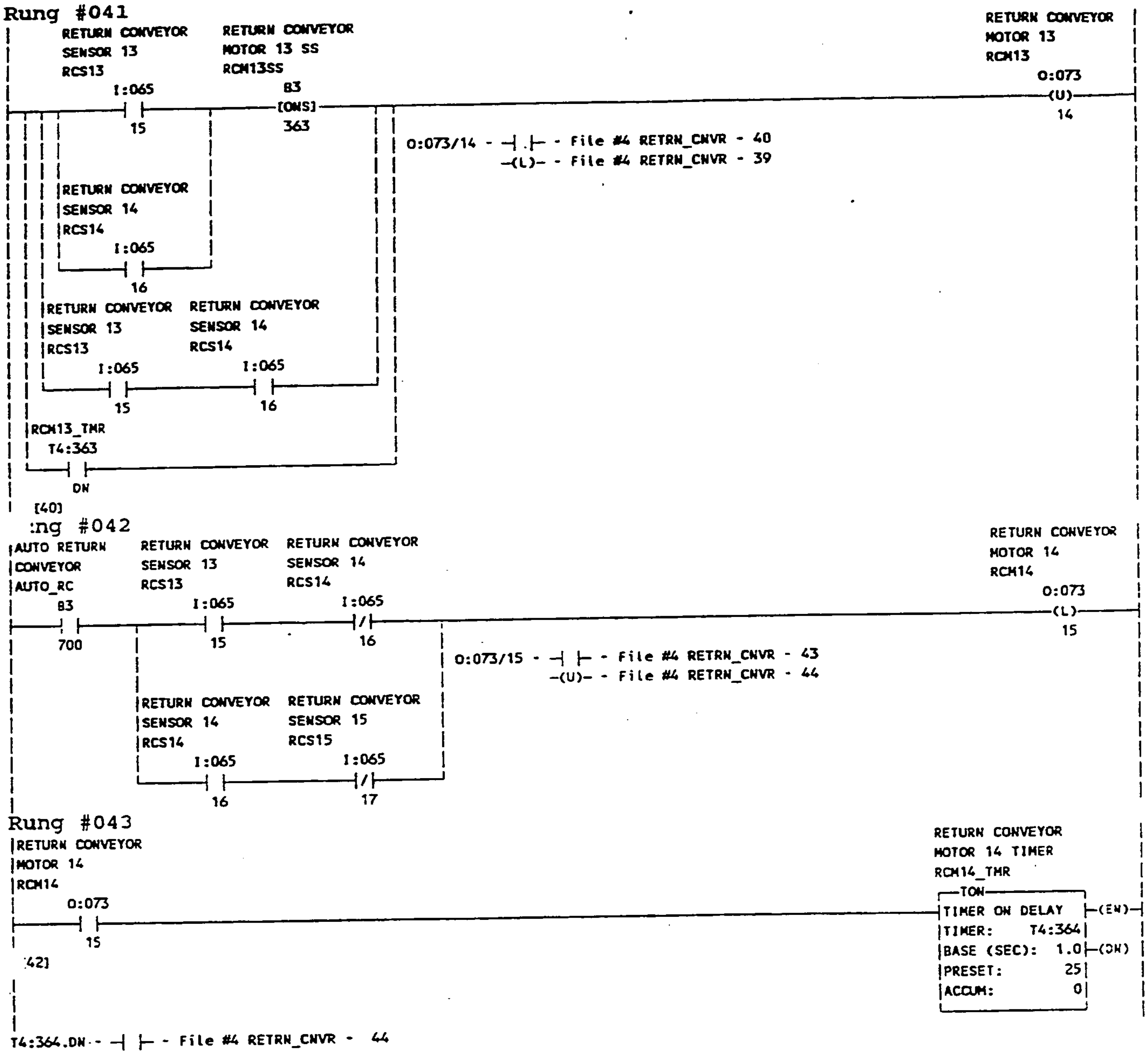
```
  RETURN CONVEYOR   RETURN CONVEYOR                              RETURN CONVEYOR
  SENSOR 12         MOTOR 12 SS                                  MOTOR 12
  RCS12             RCM12SS                                      RCM12
       I:065              B3                                        O:073
-------] [-----------[ONS]----------------------------------------(U)-----
        14               362                                          13
                                  O:073/13 - ] [ - File #4 RETRN_CNVR - 37
                                           -(L)- - File #4 RETRN_CNVR - 36
  RETURN CONVEYOR
  SENSOR 13
  RCS13
       I:065
  -----] [-----
        15
  RETURN CONVEYOR   RETURN CONVEYOR
  SENSOR 12         SENSOR 13
  RCS12             RCS13
     I:065             I:065
  ---] [---------------] [---
      14                15
  RCM12_TMR
   T4:362
  ---] [---
      DN
 [37]
```

ng #039

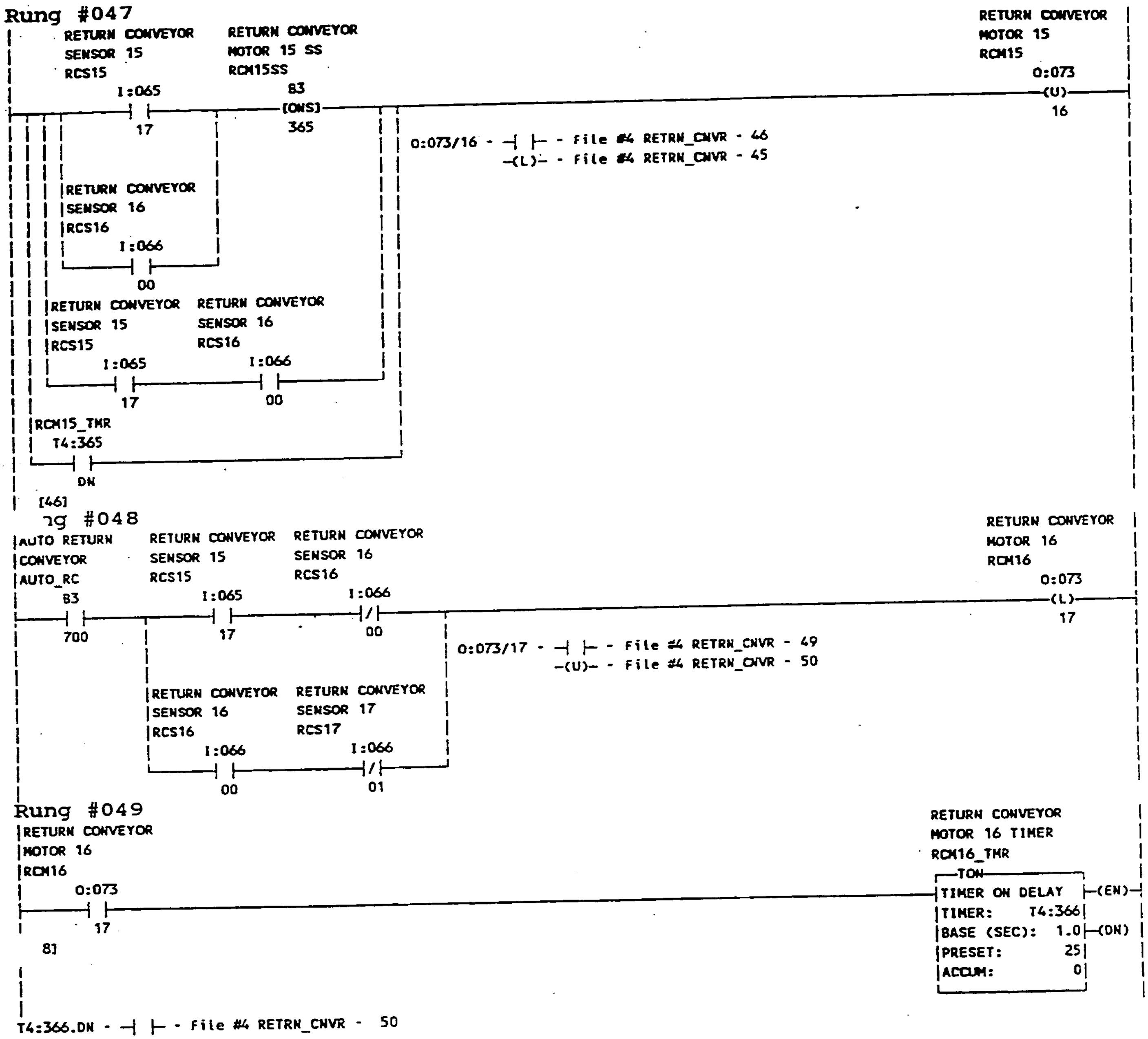
```
AUTO RETURN   RETURN CONVEYOR   RETURN CONVEYOR                  RETURN CONVEYOR
CONVEYOR      SENSOR 12         SENSOR 13                        MOTOR 13
AUTO_RC       RCS12             RCS13                            RCM13
   B3            I:065             I:065                            O:073
---] [-----------] [---------------]/[----------------------------(L)-----
   700            14                15                                 14
                                    O:073/14 - ] [ - File #4 RETRN_CNVR - 40
                                             -(U)- - File #4 RETRN_CNVR - 41
              RETURN CONVEYOR   RETURN CONVEYOR
              SENSOR 13         SENSOR 14
              RCS13             RCS14
                 I:065             I:065
              ---] [---------------]/[---
                  15                16
```

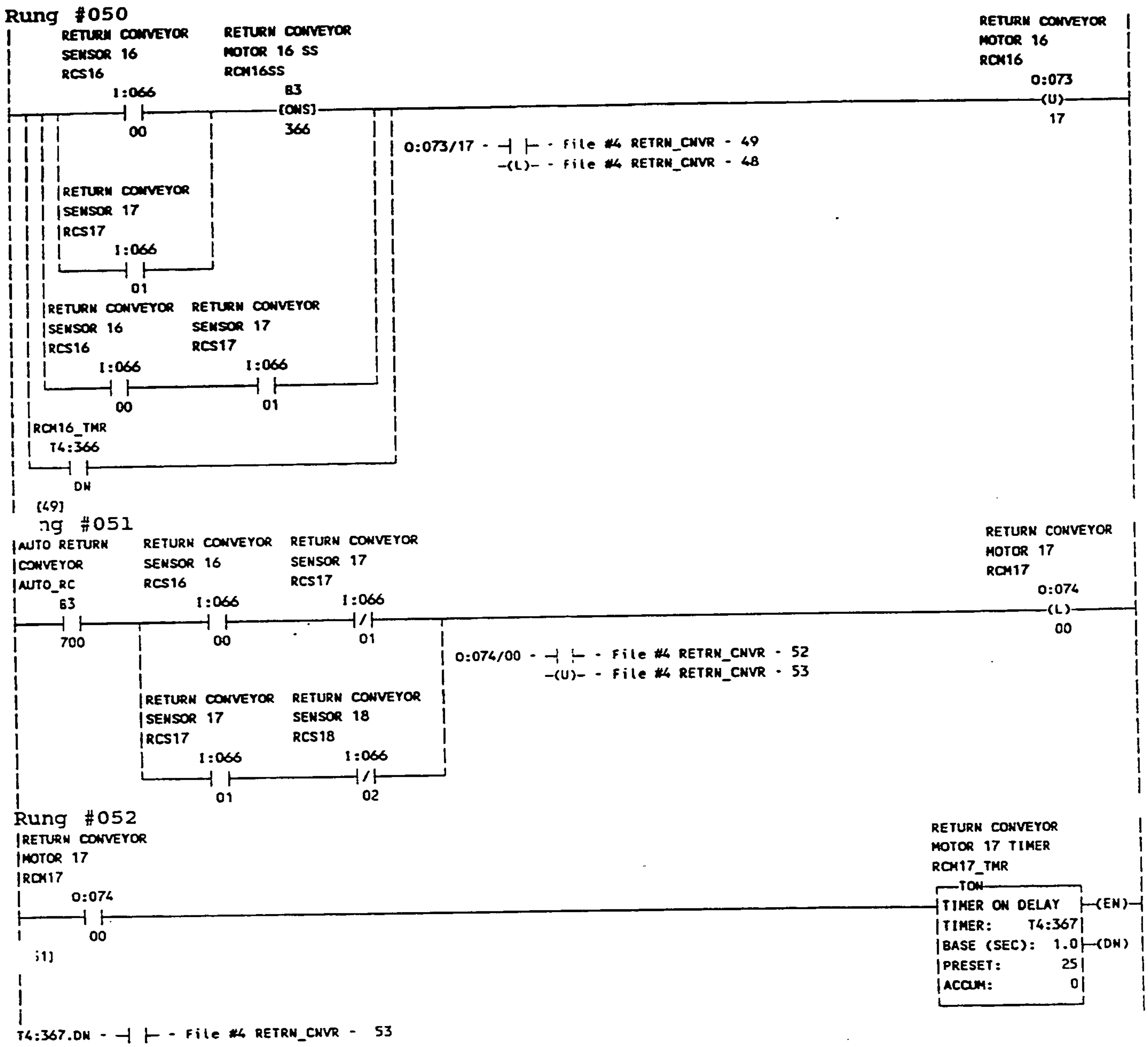
Rung #040

```
RETURN CONVEYOR                                        RETURN CONVEYOR
MOTOR 13                                               MOTOR 13 TIMER
RCM13                                                  RCM13_TMR
    O:073                                              +---TON------------+
----] [------------------------------------------------|TIMER ON DELAY    |-(EN)-
     14                                                |TIMER:     T4:363 |
 9]                                                    |BASE (SEC):   1.0 |-(DN)
                                                       |PRESET:        25 |
                                                       |ACCUM:          0 |
                                                       +------------------+
T4:363.DN - ] [ - File #4 RETRN_CNVR - 41
```


Rung #041
RETURN CONVEYOR
SENSOR 13
RCS13
I:065
15
RETURN CONVEYOR
MOTOR 13 SS
RCM13SS
B3
[ONS]
363
RETURN CONVEYOR
MOTOR 13
RCM13
O:073
(U)
14
O:073/14 - ┤ ├ - File #4 RETRN_CNVR - 40
-(L)- - File #4 RETRN_CNVR - 39
RETURN CONVEYOR
SENSOR 14
RCS14
I:065
16
RETURN CONVEYOR
SENSOR 13
RCS13
I:065
15
RETURN CONVEYOR
SENSOR 14
RCS14
I:065
16
RCM13_TMR
T4:363
DN
[40]
Rung #042
AUTO RETURN
CONVEYOR
AUTO_RC
B3
700
RETURN CONVEYOR
SENSOR 13
RCS13
I:065
15
RETURN CONVEYOR
SENSOR 14
RCS14
I:065
16
RETURN CONVEYOR
MOTOR 14
RCM14
O:073
(L)
15
O:073/15 - ┤ ├ - File #4 RETRN_CNVR - 43
-(U)- - File #4 RETRN_CNVR - 44
RETURN CONVEYOR
SENSOR 14
RCS14
I:065
16
RETURN CONVEYOR
SENSOR 15
RCS15
I:065
17
Rung #043
RETURN CONVEYOR
MOTOR 14
RCM14
O:073
15
[42]
RETURN CONVEYOR
MOTOR 14 TIMER
RCM14_TMR
TON
TIMER ON DELAY
TIMER: T4:364
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:364.DN - ┤ ├ - File #4 RETRN_CNVR - 44

```
Rung #044
|   RETURN CONVEYOR    RETURN CONVEYOR                                          RETURN CONVEYOR |
|   SENSOR 14          MOTOR 14 SS                                              MOTOR 14        |
|   RCS14              RCM14SS                                                  RCM14           |
|        I:065             B3                                                      O:073        |
|-+-+-+-----| |-------+---[ONS]---+-+-----------------------------------------------(U)---------|
| | | |       16      |   364     | |                                                15         |
| | | |               |           | | O:073/15 - -| |- - File #4 RETRN_CNVR - 43                |
| | | |               |           | |           -(L)- - File #4 RETRN_CNVR - 42                |
| | | |RETURN CONVEYOR|           | |                                                           |
| | | |SENSOR 15      |           | |                                                           |
| | | |RCS15          |           | |                                                           |
| | | |     I:065     |           | |                                                           |
| | | +-----| |-------+           | |                                                           |
| | |         17                  | |                                                           |
| | |RETURN CONVEYOR  RETURN CONVEYOR                                                           |
| | |SENSOR 14        SENSOR 15   | |                                                           |
| | |RCS14            RCS15       | |                                                           |
| | |     I:065          I:065    | |                                                           |
| | +-----| |------------| |------+ |                                                           |
| |        16             17        |                                                           |
| |RCM14_TMR                        |                                                           |
| |  T4:364                         |                                                           |
| +----| |-------------------------+                                                           |
|        DN                                                                                     |
| [43]                                                                                          |
   ng #045
|AUTO RETURN      RETURN CONVEYOR   RETURN CONVEYOR                             RETURN CONVEYOR |
|CONVEYOR         SENSOR 14         SENSOR 15                                   MOTOR 15        |
|AUTO_RC          RCS14             RCS15                                       RCM15           |
|   B3               I:065             I:065                                       O:073        |
|----| |------+--------| |---------------|/|---+------------------------------------(L)---------|
|   700       |        16                17    |                                   16           |
|             |                                | O:073/16 - -| |- - File #4 RETRN_CNVR - 46   |
|             |                                |           -(U)- - File #4 RETRN_CNVR - 47    |
|             |RETURN CONVEYOR   RETURN CONVEYOR                                               |
|             |SENSOR 15         SENSOR 16     |                                               |
|             |RCS15             RCS16         |                                               |
|             |     I:065           I:066      |                                               |
|             +-----| |---------------|/|------+                                               |
|                   17               00                                                        |
Rung #046
|RETURN CONVEYOR                                                             RETURN CONVEYOR  |
|MOTOR 15                                                                    MOTOR 15 TIMER   |
|RCM15                                                                       RCM15_TMR        |
|    O:073                                                                   +--TON-----------+       |
|------| |-------------------------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|       16                                                                   |TIMER:   T4:365 |       |
| :5]                                                                        |BASE (SEC): 1.0 +-(DN)  |
|                                                                            |PRESET:      25 |       |
|                                                                            |ACCUM:        0 |       |
|                                                                            +----------------+       |
T4:365.DN - -| |- - File #4 RETRN_CNVR - 47
```


Rung #047
RETURN CONVEYOR SENSOR 15 RCS15
I:065
17
RETURN CONVEYOR MOTOR 15 SS RCM15SS
B3
[ONS]
365
RETURN CONVEYOR MOTOR 15 RCM15
O:073
(U)
16
O:073/16 - ┤ ├ - File #4 RETRN_CNVR - 46
-(L)- - File #4 RETRN_CNVR - 45
RETURN CONVEYOR SENSOR 16 RCS16
I:066
00
RETURN CONVEYOR SENSOR 15 RCS15
I:065
17
RETURN CONVEYOR SENSOR 16 RCS16
I:066
00
RCM15_TMR
T4:365
DN
[46]
Rung #048
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 15 RCS15
I:065
17
RETURN CONVEYOR SENSOR 16 RCS16
I:066
00
RETURN CONVEYOR MOTOR 16 RCM16
O:073
(L)
17
O:073/17 - ┤ ├ - File #4 RETRN_CNVR - 49
-(U)- - File #4 RETRN_CNVR - 50
RETURN CONVEYOR SENSOR 16 RCS16
I:066
00
RETURN CONVEYOR SENSOR 17 RCS17
I:066
01
Rung #049
RETURN CONVEYOR MOTOR 16 RCM16
O:073
17
8]
RETURN CONVEYOR MOTOR 16 TIMER RCM16_TMR
TON
TIMER ON DELAY
TIMER: T4:366
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:366.DN - ┤ ├ - File #4 RETRN_CNVR - 50


Rung #050
RETURN CONVEYOR SENSOR 16 RCS16 I:066 00
RETURN CONVEYOR MOTOR 16 SS RCM16SS B3 [ONS] 366
RETURN CONVEYOR MOTOR 16 RCM16 O:073 (U) 17
0:073/17 - ┤ ├ - File #4 RETRN_CNVR - 49
-(L)- - File #4 RETRN_CNVR - 48
RETURN CONVEYOR SENSOR 17 RCS17 I:066 01
RETURN CONVEYOR SENSOR 16 RCS16 I:066 00
RETURN CONVEYOR SENSOR 17 RCS17 I:066 01
RCM16_TMR T4:366 DN
[49]
ng #051
AUTO RETURN CONVEYOR AUTO_RC B3 700
RETURN CONVEYOR SENSOR 16 RCS16 I:066 00
RETURN CONVEYOR SENSOR 17 RCS17 I:066 01
RETURN CONVEYOR MOTOR 17 RCM17 O:074 (L) 00
O:074/00 - ┤ ├ - File #4 RETRN_CNVR - 52
-(U)- - File #4 RETRN_CNVR - 53
RETURN CONVEYOR SENSOR 17 RCS17 I:066 01
RETURN CONVEYOR SENSOR 18 RCS18 I:066 02
Rung #052
RETURN CONVEYOR MOTOR 17 RCM17 O:074 00
;1]
RETURN CONVEYOR MOTOR 17 TIMER RCM17_TMR
TON
TIMER ON DELAY (EN)
TIMER: T4:367
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0
T4:367.DN - ┤ ├ - File #4 RETRN_CNVR - 53

Rung #053

RETURN CONVEYOR SENSOR 17 RCS17 I:066 01

RETURN CONVEYOR MOTOR 17 SS RCM17SS B3 [ONS] 367

RETURN CONVEYOR MOTOR 17 RCM17 O:074 -(U)- 00

RETURN CONVEYOR SENSOR 18 RCS18 I:066 02

RETURN CONVEYOR SENSOR 17 RCS17 I:066 01

RETURN CONVEYOR SENSOR 18 RCS18 I:066 02

RCM17_TMR T4:367 DN

O:074/00 - -| |- - File #4 RETRN_CNVR - 52
-(L)- - File #4 RETRN_CNVR - 51

[52]

Rung #054

.TO RETURN CONVEYOR AUTO_RC B3 700

RETURN CONVEYOR SENSOR 17 RCS17 I:066 01

RETURN CONVEYOR SENSOR 18 RCS18 I:066 -|/|- 02

RETURN CONVEYOR MOTOR 18 RCM18 O:074 -(L)- 01

RETURN CONVEYOR SENSOR 18 RCS18 I:066 02

RETURN CONVEYOR SENSOR 19 RCS19 I:066 -|/|- 03

O:074/01 - -| |- - File #4 RETRN_CNVR - 55
-(U)- - File #4 RETRN_CNVR - 56

Rung #055

RETURN CONVEYOR MOTOR 18 RCM18 O:074 01

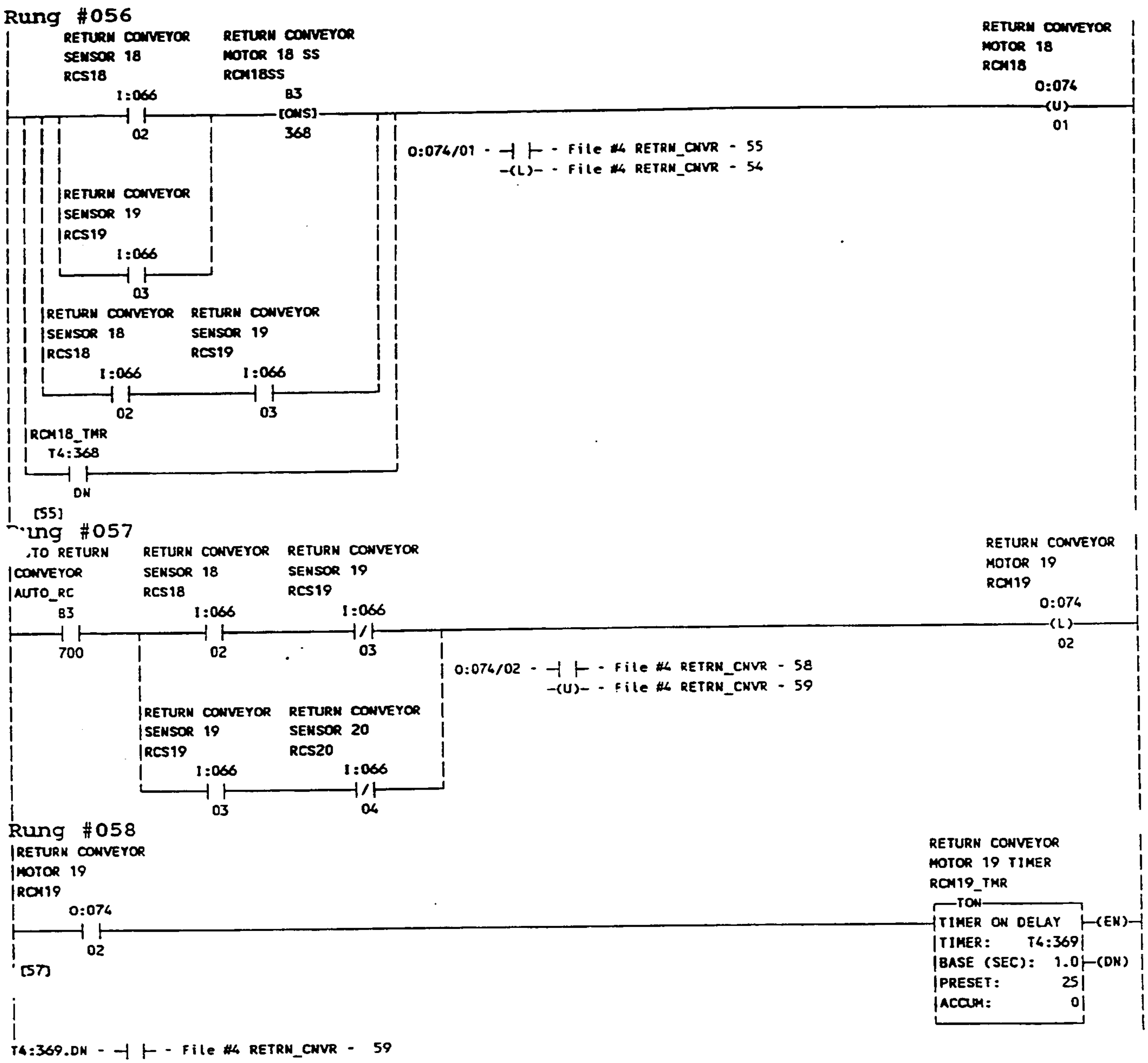
[54]

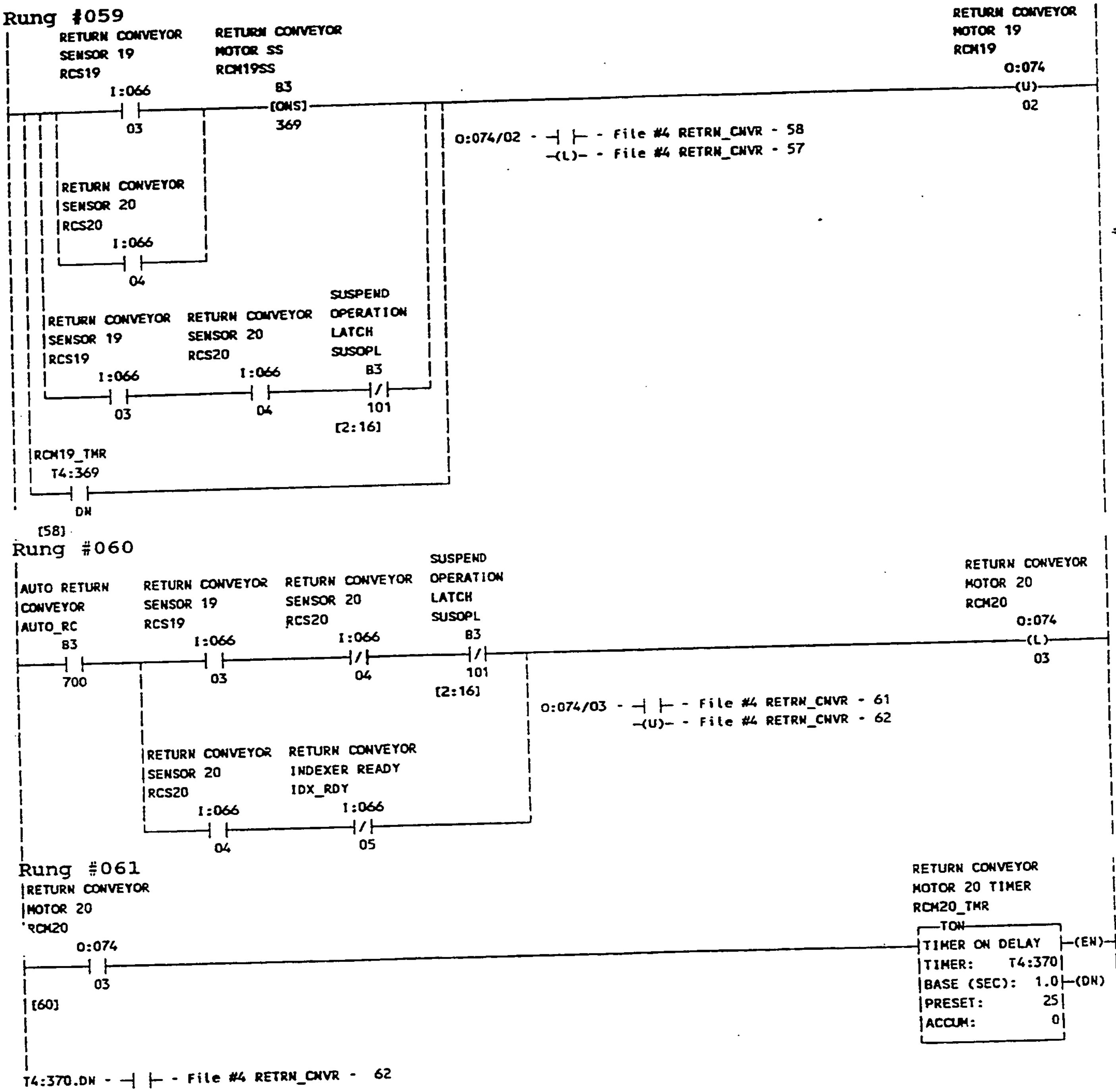
RETURN CONVEYOR MOTOR 18 TIMER RCM18_TMR

TON
TIMER ON DELAY -(EN)-
TIMER: T4:368
BASE (SEC): 1.0 -(DN)
PRESET: 25
ACCUM: 0

T4:368.DN - -| |- - File #4 RETRN_CNVR - 56

597


Rung #056
RETURN CONVEYOR SENSOR 18 RCS18
I:066
02
RETURN CONVEYOR MOTOR 18 SS RCM18SS
B3
[ONS]
368
RETURN CONVEYOR MOTOR 18 RCM18
O:074
(U)
01
O:074/01 - ┤ ├ - File #4 RETRN_CNVR - 55
-(L)- - File #4 RETRN_CNVR - 54
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR SENSOR 18 RCS18
I:066
02
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RCM18_TMR
T4:368
DN
[55]
Rung #057
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 18 RCS18
I:066
02
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR MOTOR 19 RCM19
O:074
(L)
02
O:074/02 - ┤ ├ - File #4 RETRN_CNVR - 58
-(U)- - File #4 RETRN_CNVR - 59
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
Rung #058
RETURN CONVEYOR MOTOR 19 RCM19
O:074
02
[57]
RETURN CONVEYOR MOTOR 19 TIMER RCM19_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:369
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 0
T4:369.DN - ┤ ├ - File #4 RETRN_CNVR - 59


Rung #059
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR MOTOR SS RCM19SS
B3
[ONS]
369
RETURN CONVEYOR MOTOR 19 RCM19
O:074
(U)
02
O:074/02 - ┤ ├ - File #4 RETRN_CNVR - 58
-(L)- - File #4 RETRN_CNVR - 57
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
SUSPEND OPERATION LATCH SUSOPL
B3
101
[2:16]
RCM19_TMR
T4:369
DN
[58]
Rung #060
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
SUSPEND OPERATION LATCH SUSOPL
B3
101
[2:16]
RETURN CONVEYOR MOTOR 20 RCM20
O:074
(L)
03
O:074/03 - ┤ ├ - File #4 RETRN_CNVR - 61
-(U)- - File #4 RETRN_CNVR - 62
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
RETURN CONVEYOR INDEXER READY IDX_RDY
I:066
05
Rung #061
RETURN CONVEYOR MOTOR 20 RCM20
O:074
03
[60]
RETURN CONVEYOR MOTOR 20 TIMER RCM20_TMR
TON
TIMER ON DELAY
TIMER: T4:370
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:370.DN - ┤ ├ - File #4 RETRN_CNVR - 62

599

```
Rung #062                                                              RETURN CONVEYOR
|                                                                      MOTOR 20
|                                                                      RCM20
|RCM20_TMR                                                                 O:074
| T4:370                                                                   
|---] [-------------------------------------------------------------------(U)----
|   DN                                                                      03
|[61]
O:074/03 - ] [ - File #4 RETRN_CNVR - 61
          -(L)- - File #4 RETRN_CNVR - 60
          -(U)- - File #4 RETRN_CNVR - 62
Rung #063                                                              RETURN CONVEYOR
|                                                                      INDEXER MOTOR
|AUTO RETURN  RETURN CONVEYOR  RETURN CONVEYOR                         LATCH
|CONVEYOR     SENSOR 20        INDEXER READY                           RCIML
|AUTO_RC      RCS20            IDX_RDY                                     B3
|   B3           I:066          I:066
|---] [-----------] [------------] [--------------------------------------(L)----
|   700           04             05                                        372
B3/372 - ] [ - File #4 RETRN_CNVR - 65
        ]/[ - File #4 RETRN_CNVR - 64
        -(L)- - File #4 RETRN_CNVR - 63
        -(U)- - File #4 RETRN_CNVR - 66
Rung #064                                                              RETURN CONVEYOR
|RETURN CONVEYOR                                                       INDEXER MOTOR
|INDEXER MOTOR                                                         START
``ATCH                                                                 RCIMS
 CIML                                                                      O:076
|   B3
|---]/[-------------------------------------------------------------------( )----
|   372                                                                     00
|[63]
Rung #065                                                      RETURN CONVEYOR
|RETURN CONVEYOR                                               INDEXER MOTOR
|INDEXER MOTOR                                                 TIMER
|LATCH                                                         RCIM_TMR
|RCIML                                                         +-TON-------------+
|   B3                                                         |TIMER ON DELAY   |-(EN)-
|---] [--------------------------------------------------------|TIMER:    T4:340 |
|   372                                                        |BASE (SEC):  1.0 |-(DN)
|[66]                                                          |PRESET:       15 |
|                                                              |ACCUM:         0 |
|                                                              +-----------------+
T4:340.DN - ] [ - File #4 RETRN_CNVR - 66
Rung #066                                                              RETURN CONVEYOR
|                                                                      INDEXER MOTOR
|                                                                      LATCH
|RCIM_TMR                                                              RCIML
| T4:340                                                                   B3
|---] [-------------------------------------------------------------------(U)----
|   DN                                                                      372
|[65]
B3/372 - ] [ - File #4 RETRN_CNVR - 65
        ]/[ - File #4 RETRN_CNVR - 64
        -(L)- - File #4 RETRN_CNVR - 63
        -(U)- - File #4 RETRN_CNVR - 66
Rung #067
|                                                                     +-RET--------+
|---------------------------------------------------------------------|RETURN ()   |-
|                                                                     +------------+
```

Rung #068

[END]

Rung #000

```
|AUTO                                                   MOTOR 3
|MODE     MOTOR 3  PAUSE                                FAULT
|ENABLE   FAST     DISABLE                              TIMER
|AUTO     M3F      TS12                                 M3FLT
| N7:37    O:012    N7:16                               +-TON---------------+
|--] [------] [------]/[--------------------------------|TIMER ON DELAY     |-(EN)-
|   11       12        4                                |TIMER:      T4:303 |
|[2:158]  [2:185]  [2:3]                                |BASE (SEC):   1.0  |-(DN)
|                                                       |PRESET:       100  |
|                                                       |ACCUM:          0  |
|                                                       +-------------------+
T4:303.DN - ] [ - File #5 FAULTS - 15
```

Rung #001

```
|AUTO                                                   MOTOR 4
|MODE     MOTOR 4  PAUSE                                FAULT
|ENABLE   FAST     DISABLE                              TIMER
|AUTO     M4F      TS12                                 M4FLT
| N7:37    O:012    N7:16                               +-TON---------------+
|--] [------] [------]/[--------------------------------|TIMER ON DELAY     |-(EN)-
|   11       13        4                                |TIMER:      T4:304 |
|[2:158]  [2:190]  [2:3]                                |BASE (SEC):   1.0  |-(DN)
|                                                       |PRESET:       100  |
|                                                       |ACCUM:          0  |
|                                                       +-------------------+
T4:304.DN - ] [ - File #5 FAULTS - 15
```

Rung #002

```
 JTO                                                    MOTOR 5
|MODE     MOTOR 5  PAUSE                                FAULT
|ENABLE   FAST     DISABLE                              TIMER
|AUTO     M5F      TS12                                 M5FLT
| N7:37    O:012    N7:16                               +-TON---------------+
|--] [------] [------]/[--------------------------------|TIMER ON DELAY     |-(EN)-
|   11       14        4                                |TIMER:      T4:305 |
|[2:158]  [2:195]  [2:3]                                |BASE (SEC):   1.0  |-(DN)
|                                                       |PRESET:       100  |
|                                                       |ACCUM:          0  |
|                                                       +-------------------+
T4:305.DN - ] [ - File #5 FAULTS - 15
```

Rung #003

```
|AUTO                                                   MOTOR 6 OR 7
|MODE      MOTOR 6     PAUSE                            FAULT
|ENABLE    FAST        DISABLE                          TIMER
|AUTO      M6F         TS12                             M6,7FLT
| N7:37     O:012       N7:16                           +-TON---------------+
|--] [---+---] [---+-----]/[----------------------------|TIMER ON DELAY     |-(EN)-
|   11   |   15    |      4                             |TIMER:      T4:306 |
|[2:158] |[2:218]  |   [2:3]                            |BASE (SEC):   1.0  |-(DN)
|        |         |                                    |PRESET:       200  |
|        |         |                                    |ACCUM:         62  |
|        |         |                                    +-------------------+
|        |MOTOR 7  |
|        |FAST     |
|        |M7F      |
|        |  O:012  |
|        +---] [---+
|            16
|         [2:231]
T4:306.DN - ] [ - File #5 FAULTS - 15
```

602

```
Rung #004
|AUTO                                                         MOTOR 8
|MODE     MOTOR 8  PAUSE                                      FAULT TIMER
|ENABLE   FAST     DISABLE                                    M8FLT
|AUTO     M8F      TS12                                       +-TON---------------+
| N7:37    O:012    N7:16                                  ---|TIMER ON DELAY     |-(EN)-
|--| |------| |------|/|--------------------------------------|TIMER:      T4:335|
|   11       17       4                                       |BASE (SEC):   1.0|-(DN)
|[2:158]  [2:249]  [2:3]                                      |PRESET:        200|
|                                                             |ACCUM:           4|
|                                                             +-------------------+
T4:335.DN - -| |- - File #5 FAULTS -  15
Rung #005
|AUTO                                                         MOTOR 9
|MODE     MOTOR 9  PAUSE                                      FAULT FAULT
|ENABLE   FAST     DISABLE                                    M9FLT
|AUTO     M9F      TS12                                       +-TON---------------+
| N7:37    O:032    N7:16                                  ---|TIMER ON DELAY     |-(EN)-
|--| |------| |------|/|--------------------------------------|TIMER:      T4:307|
|   11       10       4                                       |BASE (SEC):   1.0|-(DN)
|[2:158]  [2:253]  [2:3]                                      |PRESET:        150|
|                                                             |ACCUM:           0|
|                                                             +-------------------+
T4:307.DN - -| |- - File #5 FAULTS -  15
P''ng #006
  O                                                           MOTOR 10 OR 11
|MODE       MOTOR 10     PAUSE                                FAULT
|ENABLE     FAST         DISABLE                              TIMER
|AUTO       M10F         TS12                                 M10,11FLT
| N7:37      O:032        N7:16                               +-TON---------------+
|--| |---+---| |---+------|/|---------------------------------|TIMER ON DELAY     |-(EN)-
|   11   |    11   |       4                                  |TIMER:      T4:308|
|[2:158] |[2:258]  |    [2:3]                                 |BASE (SEC):   1.0|-(DN)
|        |         |                                          |PRESET:        200|
|        |         |                                          |ACCUM:           0|
|        |MOTOR 11 |                                          +-------------------+
|        |FAST     |
|        |M11F     |
|        |  O:032  |
|        +---| |---+
|            12
|         [2:263]
T4:308.DN - -| |- - File #5 FAULTS -  15
Rung #007
|AUTO                                                         MOTOR 12
'MODE     MOTOR 12  PAUSE                                     FAULT TIMER
 ABLE     FAST      DISABLE                                   M12FLT
|AUTO     M12F      TS12                                      +-TON---------------+
| N7:37    O:032    N7:16                                  ---|TIMER ON DELAY     |-(EN)-
|--| |------| |------|/|--------------------------------------|TIMER:      T4:336|
|   11       13       4                                       |BASE (SEC):   1.0|-(DN)
|[2:158]  [2:281]  [2:3]                                      |PRESET:        200|
|                                                             |ACCUM:           0|
|                                                             +-------------------+
T4:336.DN - -| |- - File #5 FAULTS -  15
```

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```
Rung #008
|AUTO
|MODE     MOTOR 13  PAUSE                                                          MOTOR 13
|ENABLE   FAST      DISABLE                                                        FAULT TIMER
|AUTO     M13F      TS12                                                           M13FLT
| N7:37    O:032     N7:16                                                         +-TON----------------+
|-| |------| |------|/|-----------------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  11       14        4                                                            |TIMER:      T4:309|
|[2:158] [2:285]   [2:3]                                                           |BASE (SEC):   1.0+-(DN)
|                                                                                  |PRESET:        150|
|                                                                                  |ACCUM:           0|
|                                                                                  +------------------+
T4:309.DN - -| |- - File #5 FAULTS -  15
Rung #009
|                                 PALLET
|AUTO                             DETECTED
|MODE     MOTOR 14     PAUSE      RIGHT SIDE                                       MOTOR 14 OR 15
|ENABLE   FAST         DISABLE    CARBON                                           FAULT TIMER
|AUTO     M14F         TS12       SEN42                                            M14,15FLT
| N7:37     O:032        N7:16      I:053                                          +-TON----------------+
|-| |---+---| |---+-----|/|--------|/|---------------------------------------------+TIMER ON DELAY      +-(EN)-
|  11   |    15   |      4          02                                             |TIMER:      T4:310|
|[2:158]| [2:290] |   [2:3]                                                        |BASE (SEC):   1.0+-(DN)
|       |         |                                                                |PRESET:        180|
|       |         |                                                                |ACCUM:          47|
|       |         |                                                                +------------------+
|       |MOTOR 15 |
|       |FAST     |
|       |M15F     |
|       |  O:032  |
|       +---| |---+
|           16
|        [2:295]
T4:310.DN - -| |- - File #5 FAULTS -  15
Rung #010
|                             PALLET
|AUTO                         DETECTED
|MODE     MOTOR 16  PAUSE     RIGHT SIDE                                           MOTOR 16
|ENABLE   FAST      DISABLE   DWELL 6                                              FAULT TIMER
|AUTO     M16F      TS12      SEN45                                                M16FLT
| N7:37    O:032     N7:16     I:053                                               +-TON----------------+
|-| |------| |------|/|-------|/|-------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  11       17        4         05                                                 |TIMER:      T4:337|
|[2:158] [2:306]   [2:3]                                                           |BASE (SEC):   1.0+-(DN)
|                                                                                  |PRESET:        120|
|                                                                                  |ACCUM:          15|
|                                                                                  +------------------+
T4:337.DN - -| |- - File #5 FAULTS -  15
Rung #011
|                             PALLET
|AUTO                         DETECTED
|MODE     MOTOR 17  PAUSE     RIGHT SIDE                                           MOTOR 17
|ENABLE   FAST      DISABLE   BUFFER 4                                             FAULT TIMER
|AUTO     M17F      TS12      SEN48                                                M17FLT
| N7:37    O:062     N7:16     I:053                                               +-TON----------------+
|-| |------| |------|/|-------|/|-------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  11       10        4         10                                                 |TIMER:      T4:311|
|[2:158] [2:310]   [2:3]                                                           |BASE (SEC):   1.0+-(DN)
|                                                                                  |PRESET:        130|
|                                                                                  |ACCUM:           0|
|                                                                                  +------------------+
T4:311.DN - -| |- - File #5 FAULTS -  15
```

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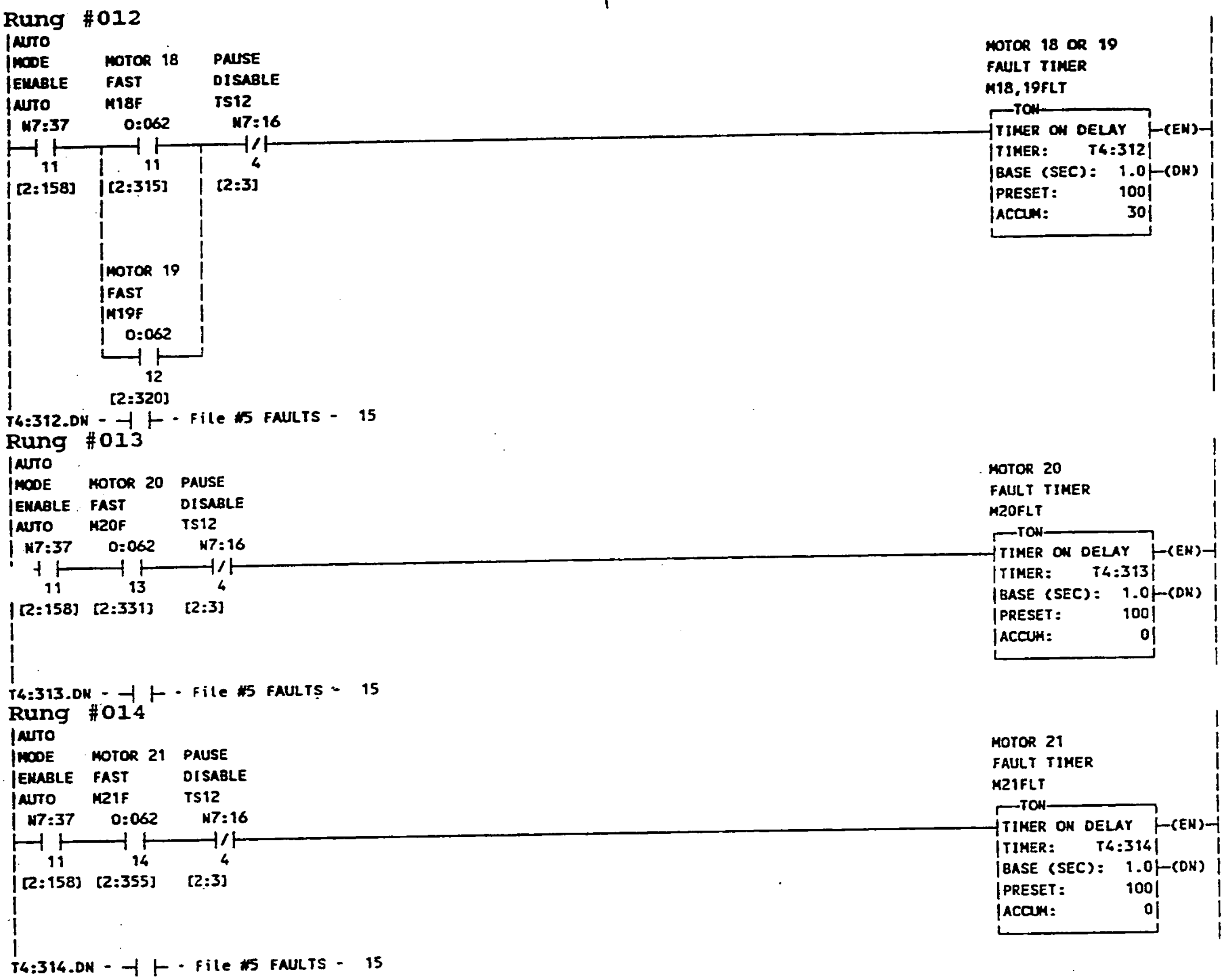
Rung #012
AUTO MODE ENABLE AUTO N7:37 11 [2:158]
MOTOR 18 FAST M18F 0:062 11 [2:315]
MOTOR 19 FAST M19F 0:062 12 [2:320]
PAUSE DISABLE TS12 N7:16 4 [2:3]
MOTOR 18 OR 19 FAULT TIMER M18,19FLT
TON
TIMER ON DELAY
TIMER: T4:312
BASE (SEC): 1.0
PRESET: 100
ACCUM: 30
(EN)
(DN)
T4:312.DN - File #5 FAULTS - 15
Rung #013
AUTO MODE ENABLE AUTO N7:37 11 [2:158]
MOTOR 20 FAST M20F 0:062 13 [2:331]
PAUSE DISABLE TS12 N7:16 4 [2:3]
MOTOR 20 FAULT TIMER M20FLT
TON
TIMER ON DELAY
TIMER: T4:313
BASE (SEC): 1.0
PRESET: 100
ACCUM: 0
(EN)
(DN)
T4:313.DN - File #5 FAULTS - 15
Rung #014
AUTO MODE ENABLE AUTO N7:37 11 [2:158]
MOTOR 21 FAST M21F 0:062 14 [2:355]
PAUSE DISABLE TS12 N7:16 4 [2:3]
MOTOR 21 FAULT TIMER M21FLT
TON
TIMER ON DELAY
TIMER: T4:314
BASE (SEC): 1.0
PRESET: 100
ACCUM: 0
(EN)
(DN)
T4:314.DN - File #5 FAULTS - 15

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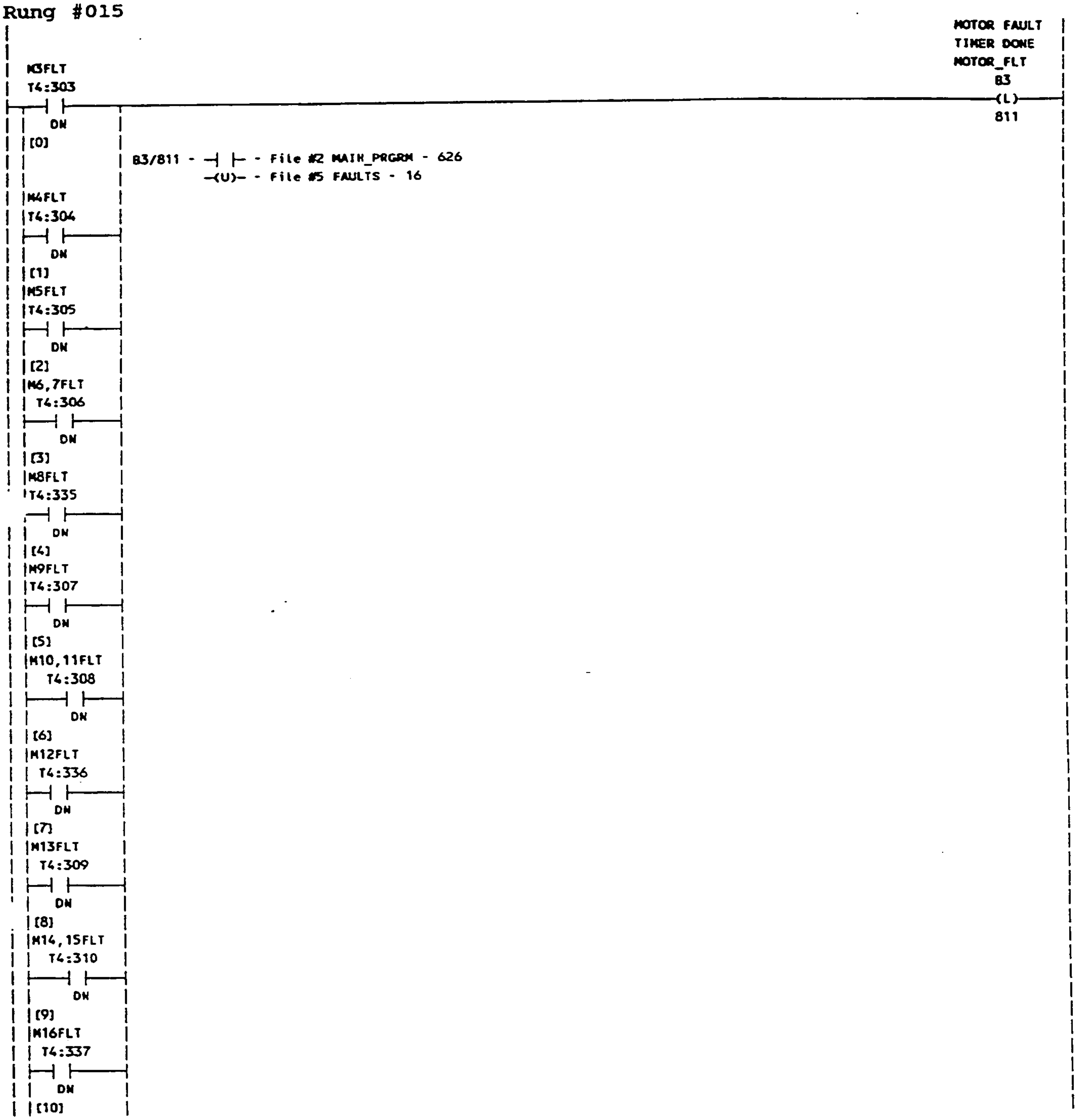
Rung #015


MOTOR FAULT
TIMER DONE
MOTOR_FLT
B3
(L)
811
M3FLT
T4:303
DN
[0]
B3/811 - ⊣ ⊢ - File #2 MAIN_PRGRM - 626
-(U)- - File #5 FAULTS - 16
M4FLT
T4:304
DN
[1]
M5FLT
T4:305
DN
[2]
M6,7FLT
T4:306
DN
[3]
M8FLT
T4:335
DN
[4]
M9FLT
T4:307
DN
[5]
M10,11FLT
T4:308
DN
[6]
M12FLT
T4:336
DN
[7]
M13FLT
T4:309
DN
[8]
M14,15FLT
T4:310
DN
[9]
M16FLT
T4:337
DN
[10]

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```
Rung #016                                                          MOTOR FAULT |
|PAUSE                                                             TIMER DONE  |
|DISABLE                                                           MOTOR_FLT   |
|TS12                                                                   B3     |
|  N7:16                                                              -(U)-----|
|---] [------------------------------------------------------------------------|
|     4                                                                811     |
|[2:3]
B3/811 - ] [ - File #2 MAIN_PRGRM - 626
        -(L)- - File #5 FAULTS - 15
        -(U)- - File #5 FAULTS - 16
Rung #017                                                   DOOR 1            |
|DOOR CLOSE                                                 CLOSE             |
|SOLENOID                                                   TIMER             |
|1 ENABLE                                                   D1CLTMR           |
|DRCL1                                                     +-TON-------------+ |
|   O:011                                                  |TIMER ON DELAY   |-(EN)-|
|---] [----------------------------------------------------|TIMER:     T4:81 |      |
|     00                                                   |BASE (SEC):  1.0 |-(DN) |
|[2:183]                                                   |PRESET:        4 |      |
|                                                          |ACCUM:         0 |      |
|                                                          +-----------------+      |
T4:81.DN - ] [ - File #5 FAULTS - 18
Rung #018                                                         |
|FAULT                                                      DOOR 1 |
|DETECT                                                     CLOSED |
|DOOR 1   DOOR 1                                            FAULT  |
|CLOSED   CLOSED                                            D1CLFLT|
|D1CLTMR  DRCL1S                                               B3  |
| T4:81    I:006                                           -( )---|
|---] [-----]/[--------------------------------------------------------|
|   DN       00                                               201  |
|[17]
B3/201 - ]/[ - File #5 FAULTS - 65
        -( )- - File #5 FAULTS - 18
Rung #019                                                   DOOR 2            |
|DOOR CLOSE                                                 CLOSE             |
|SOLENOID                                                   TIMER             |
|2 ENABLE                                                   D2CLTMR           |
|DRCL2                                                     +-TON-------------+ |
|   O:011                                                  |TIMER ON DELAY   |-(EN)-|
|---] [----------------------------------------------------|TIMER:     T4:82 |      |
|     02                                                   |BASE (SEC):  1.0 |-(DN) |
|[2:202]                                                   |PRESET:        4 |      |
|                                                          |ACCUM:         0 |      |
|                                                          +-----------------+      |
T4:82.DN - ] [ - File #5 FAULTS - 20
Rung #020                                                         |
|FAULT                                                      DOOR 2 |
|DETECT                                                     CLOSED |
|DOOR 2   DOOR 2                                            FAULT  |
|CLOSED   CLOSED                                            D2CLFLT|
|D2CLTMR  DRCL2S                                               B3  |
| T4:82    I:006                                           -( )---|
|---] [-----]/[--------------------------------------------------------|
|   DN       02                                               202  |
|[19]
B3/202 - ]/[ - File #5 FAULTS - 65
        -( )- - File #5 FAULTS - 20
```

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```
Rung #021
|                                                              DOOR 3
|CLOSE                                                         CLOSE
|DOOR 3                                                        TIMER
|DRCL3                                                         D3CLTMR
| O:011                                                        +-TON-----------------+
|--] [---------------------------------------------------------|TIMER ON DELAY       |-(EN)-|
|   04                                                         |TIMER:         T4:83 |
|[2:229]                                                       |BASE (SEC):      1.0 |-(DN) |
|                                                              |PRESET:            4 |
|                                                              |ACCUM:             0 |
|                                                              +---------------------+
T4:83.DN - ] [ - File #5 FAULTS - 22
Rung #022
|FAULT
|DETECT                                                            DOOR 3
|DOOR 3    DOOR 3                                                  CLOSED
|CLOSED    CLOSED                                                  FAULT
|D3CLTMR   DRCL3S                                                  D3CLFLT
|  T4:83    I:006                                                    B3
|---] [------]/[------------------------------------------------------( )---|
|    DN       04                                                     203
|[21]
B3/203 - ]/[ - File #5 FAULTS - 65
       -( )- - File #5 FAULTS - 22
Rung #023
|DOOR CLOSE                                                    DOOR 4
|SOLENOID                                                      CLOSE
|4 ENABLE                                                      TIMER
|DRCL4                                                         D4CLTMR
|   O:011                                                      +-TON-----------------+
|----] [-------------------------------------------------------|TIMER ON DELAY       |-(EN)-|
|     06                                                       |TIMER:         T4:84 |
|[2:408]                                                       |BASE (SEC):      1.0 |-(DN) |
|                                                              |PRESET:            4 |
|                                                              |ACCUM:             0 |
|                                                              +---------------------+
T4:84.DN - ] [ - File #5 FAULTS - 24
Rung #024
|FAULT
|DETECT                                                            DOOR 4
|DOOR 4    DOOR 4                                                  CLOSED
|CLOSED    CLOSED                                                  FAULT
|D4CLTMR   DRCL4S                                                  D4CLFLT
|  T4:84    I:006                                                    B3
|---] [------]/[------------------------------------------------------( )---|
|    DN       06                                                     204
|[23]
B3/204 - ]/[ - File #5 FAULTS - 65
       -( )- - File #5 FAULTS - 24
Rung #025
|DOOR CLOSE                                                    DOOR 5
|SOLENOID                                                      CLOSE
|5 ENABLE                                                      TIMER
|DRCL5                                                         D5CLTMR
|   O:031                                                      +-TON-----------------+
|----] [-------------------------------------------------------|TIMER ON DELAY       |-(EN)-|
|     00                                                       |TIMER:         T4:85 |
|[2:414]                                                       |BASE (SEC):      1.0 |-(DN) |
|                                                              |PRESET:            4 |
|                                                              |ACCUM:             0 |
|                                                              +---------------------+
```

```
T4:85.DN - -| |- - File #5 FAULTS -  26
Rung #026
|FAULT                                                          DOOR 5  |
|DETECT                                                         CLOSED  |
|DOOR 5   DOOR 5                                                FAULT   |
|CLOSED   CLOSED                                                D5CLFLT |
|D5CLTMR  DRCL5S                                                  B3    |
|  T4:85   I:026                                                        |
|---| |-----|/|-------------------------------------------------( )------|
|    DN      00                                                  205    |
|[25]
B3/205 - -|/|- - File #5 FAULTS -  65
        -( )- - File #5 FAULTS -  26
Rung #027
|DOOR CLOSE                                      DOOR 6                 |
|SOLENOID                                        CLOSE                  |
|6 ENABLE                                        TIMER                  |
|DRCL6                                           D6CLTMR                |
|  O:031                                         +-TON-------------+    |
|---| |------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    02                                          |TIMER:     T4:86 |    |
|[2:420]                                         |BASE (SEC):  1.0 |-(DN)|
|                                                |PRESET:        4 |    |
|                                                |ACCUM:         0 |    |
|                                                +-----------------+    |
T4:86.DN - -| |- - File #5 FAULTS -  28
Rung #028
 JLT                                                            DOOR 6  |
|DETECT                                                         CLOSED  |
|DOOR 6   DOOR 6                                                FAULT   |
|CLOSED   CLOSED                                                D6CLFLT |
|D6CLTMR  DRCL6S                                                  B3    |
|  T4:86   I:026                                                        |
|---| |-----|/|-------------------------------------------------( )------|
|    DN      02                                                  206    |
|[27]
B3/206 - -|/|- - File #5 FAULTS -  65
        -( )- - File #5 FAULTS -  28
Rung #029
|DOOR CLOSE                                      DOOR 7                 |
|SOLENOID                                        CLOSE                  |
|7 ENABLE                                        TIMER                  |
|DRCL7                                           D7CLTMR                |
|  O:045                                         +-TON-------------+    |
|---| |------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    00                                          |TIMER:     T4:87 |    |
|[2:422]                                         |BASE (SEC):  1.0 |-(DN)|
|                                                |PRESET:        4 |    |
|                                                |ACCUM:         0 |    |
                                                 +-----------------+    |
T4:87.DN - -| |- - File #5 FAULTS -  30
Rung #030
|FAULT                                                          DOOR 7  |
|DETECT                                                         CLOSED  |
|DOOR 7   DOOR 7                                                FAULT   |
|CLOSED   CLOSED                                                D7CLFLT |
|D7CLTMR  DRCL7S                                                  B3    |
|  T4:87   I:042                                                        |
|---| |-----|/|-------------------------------------------------( )------|
|    DN      00                                                  207    |
|[29]
B3/207 - -|/|- - File #5 FAULTS -  65
```

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```
        -( )- - File #5 FAULTS -  30
Rung  #031
|DOOR CLOSE                                                                    DOOR 8           |
|SOLENOID                                                                      CLOSE            |
|8 ENABLE                                                                      TIMER            |
|DRCL8                                                                         D8CLTMR          |
|  O:045                                                                       +--TON-------+   |
|---] [--------------------------------------------------------------------+--|TIMER ON DELAY |-(EN)-|
|   02                                                                         |TIMER:   T4:88|   |
|[2:427]                                                                       |BASE (SEC): 1.0|-(DN) |
|                                                                              |PRESET:      4|   |
|                                                                              |ACCUM:       0|   |
|                                                                              +--------------+   |
T4:88.DN - -] [- - File #5 FAULTS -  32
Rung  #032
|FAULT                                                                                           |
|DETECT                                                                                  DOOR 8  |
|DOOR 8    DOOR 8                                                                        CLOSED  |
|CLOSED    CLOSED                                                                        FAULT   |
|D8CLTMR   DRCL8S                                                                        D8CLFLT |
| T4:88    I:042                                                                           B3    |
|---] [------]/[-------------------------------------------------------------------------( )----|
|   DN       02                                                                           208    |
|[31]
B3/208 - -]/[- - File #5 FAULTS -  65
        -( )- - File #5 FAULTS -  32
~~ng  #033
 OSE
|DOOR 9                                                                        DOOR 9           |
|SOLENOID                                                                      CLOSE            |
|ENABLE                                                                        TIMER            |
|DRCL9                                                                         D9CLTMR          |
|  O:061                                                                       +--TON-------+   |
|---] [--------------------------------------------------------------------+--|TIMER ON DELAY |-(EN)-|
|   00                                                                         |TIMER:   T4:89|   |
|[2:329]                                                                       |BASE (SEC): 1.0|-(DN) |
|                                                                              |PRESET:      4|   |
|                                                                              |ACCUM:       0|   |
|                                                                              +--------------+   |
T4:89.DN - -] [- - File #5 FAULTS -  34
Rung  #034
|FAULT                                                                                           |
|DETECT                                                                                  DOOR 9  |
|DOOR 9    DOOR 9                                                                        CLOSED  |
|CLOSED    CLOSED                                                                        FAULT   |
|D9CLTMR   DRCL9S                                                                        D9CLFLT |
| T4:89    I:056                                                                           B3    |
|---] [------]/[-------------------------------------------------------------------------( )----|
    DN       00                                                                           209    |
 .33]
B3/209 - -]/[- - File #5 FAULTS -  65
        -( )- - File #5 FAULTS -  34
Rung  #035
|                                                                              DOOR 10          |
|CLOSE DOOR                                                                    CLOSE            |
|10 ENABLE                                                                     TIMER            |
|DRCL10                                                                        D10CLTMR         |
|  O:061                                                                       +--TON-------+   |
|---] [--------------------------------------------------------------------+--|TIMER ON DELAY |-(EN)-|
|   02                                                                         |TIMER:   T4:90|   |
|[2:335]                                                                       |BASE (SEC): 1.0|-(DN) |
|                                                                              |PRESET:      4|   |
|                                                                              |ACCUM:       0|   |
>                                                                              >>>>>>>>>>>>>>>>>>   >
```

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T4:90.DN - -| |- - File #5 FAULTS - 36
Rung #036
|FAULT                                                      DOOR 10
|DETECT                                                     CLOSED
|DOOR 10    DOOR 10                                         FAULT
|CLOSED     CLOSED                                          D10CLFLT
|D10CLTMR   DRCL10S                                            B3
|  T4:90      I:056
|---| |-------|/|-----------------------------------------------( )---|
|    DN        02                                              210
|[35]
B3/210 - -|/|- - File #5 FAULTS - 65
         -( )- - File #5 FAULTS - 36
Rung #037                                              DOOR 11
|                                                      CLOSE
|CLOSE                                                 TIMER
|DOOR 11                                               D11CLTMR
|DRCL11                                                +-TON----------------+
|  O:061                                               |TIMER ON DELAY      |-(EN)-|
|---| |------------------------------------------------|TIMER:        T4:91 |
|    04                                                |BASE (SEC):     1.0 |-(DN)
|[2:337]                                               |PRESET:           4 |
|                                                      |ACCUM:            0 |
|                                                      +--------------------+

  91.DN - -| |- - File #5 FAULTS - 38
Rung #038
|FAULT                                                      DOOR 11
|DETECT                                                     CLOSED
|DOOR 11    DOOR 11                                         FAULT
|CLOSED     CLOSED                                          D11CLFLT
|D11CLTMR   DRCL11S                                            B3
|  T4:91      I:056
|---| |-------|/|-----------------------------------------------( )---|
|    DN        04                                              211
|[37]
B3/211 - -|/|- - File #5 FAULTS - 65
         -( )- - File #5 FAULTS - 38
Rung #039                                              DOOR 12
|DOOR CLOSE                                            CLOSE
|SOLENOID12                                            TIMER
|ENABLE                                                D12CLTMR
|DRCL12                                                +-TON----------------+
|  O:061                                               |TIMER ON DELAY      |-(EN)-|
|---| |------------------------------------------------|TIMER:        T4:92 |
|    06                                                |BASE (SEC):     1.0 |-(DN)
 [2:353]                                               |PRESET:           4 |
                                                       |ACCUM:            0 |
|                                                      +--------------------+
|
T4:92.DN - -| |- - File #5 FAULTS - 40
Rung #040                                                   DOOR 12
|FAULT                                                      CLOSED
|DETECT     DOOR 12                                         FAULT
|DOOR 12    CLOSED                                          D12CLFLT
|D12CLTMR   DRCL12S                                            B3
|  T4:92      I:056
|---| |-------|/|-----------------------------------------------( )---|
|    DN        06                                              212
|[39]
```

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B3/212 - -|/|- - File #5 FAULTS -  65
         -( )- - File #5 FAULTS -  40
Rung #041
|                                                              DOOR 1                  |
|OPEN DOOR                                                     OPEN                    |
|1                                                             TIMER                   |
|DROP1                                                         D1OPTMR                 |
|  O:011                                                      +-TON--------------+     |
|--] [--------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|   01                                                        |TIMER:     T4:101|     |
|[2:181]                                                      |BASE (SEC):   1.0+-(DN) |
|                                                             |PRESET:         4|     |
|                                                             |ACCUM:          0|     |
|                                                             +------------------+     |
T4:101.DN - -] [- - File #5 FAULTS -  42
Rung #042
|FAULT                                                                     DOOR 1      |
|DETECTED                                                                  OPEN        |
|DOOR 1     DOOR 1                                                         FAULT       |
|OPEN       OPEN                                                           D1OPFLT     |
|D1OPTMR    DROP1S                                                           B3        |
| T4:101    I:006                                                                      |
|--] [--------]/[------------------------------------------------------------( )-------|
|   DN        01                                                             221       |
|[41]
B3/221 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  42
 ng #043
|OPEN DOOR                                                     DOOR 2                  |
|SOLENOID                                                      OPEN                    |
|2 ENABLE                                                      TIMER                   |
|DROP2                                                         D2OPTMR                 |
|  O:011                                                      +-TON--------------+     |
|--] [--------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|   03                                                        |TIMER:     T4:102|     |
|[2:200]                                                      |BASE (SEC):   1.0+-(DN) |
|                                                             |PRESET:         4|     |
|                                                             |ACCUM:          2|     |
|                                                             +------------------+     |
T4:102.DN - -] [- - File #5 FAULTS -  44
Rung #044
|FAULT                                                                     DOOR 2      |
|DETECT                                                                    OPEN        |
|DOOR 2     DOOR 2                                                         FAULT       |
|OPEN       OPEN                                                           D2OPFLT     |
|D2OPTMR    DROP2S                                                           B3        |
| T4:102    I:006                                                                      |
|--] [--------]/[------------------------------------------------------------( )-------|
'   DN        03                                                             222       |
 :3]
B3/222 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  44
Rung #045
|DOOR OPEN                                                     DOOR 3                  |
|SOLENOID                                                      OPEN                    |
|3 ENABLE                                                      TIMER                   |
|DROP3                                                         D3OPTMR                 |
|  O:011                                                      +-TON--------------+     |
|--] [--------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|   05                                                        |TIMER:     T4:103|     |
|[2:216]                                                      |BASE (SEC):   1.0+-(DN) |
|                                                             |PRESET:         4|     |
|                                                             |ACCUM:          0|     |
>                                                             >>>>>>>>>>>>>>>>>>>      >
```

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```
                                                                      <<<<<<<<<<<<<<<<<<<<     <
<
|
T4:103.DN - -| |- - File #5 FAULTS -  46
Rung #046
|FAULT
|DETECT                                                                      DOOR 3
|DOOR 3   DOOR 3                                                             OPEN
|OPEN     OPEN                                                               FAULT
|D3OPTMR  DROP3S                                                             D3OPFLT
| T4:103   I:006                                                             B3
|--| |-----|/|----------------------------------------------------------------( )---|
|   DN      05                                                               223
|[45]
B3/223 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  46
Rung #047
|DOOR OPEN                                                     DOOR 4
|SOLENOID                                                      OPEN
|4 ENABLE                                                      TIMER
|DROP4                                                         D4OPTMR
|  O:011                                                       +-TON-------------+
|--| |---------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    07                                                        |TIMER:    T4:104 |
|[2:415]                                                       |BASE (SEC):  1.0 |-(DN)
|                                                              |PRESET:        4 |
|                                                              |ACCUM:         0 |
|                                                              +-----------------+
  T4.DN - -| |- - File #5 FAULTS -  48
Rung #048
|FAULT
|DETECT                                                                      DOOR 4
|DOOR 4   DOOR 4                                                             OPEN
|OPEN     OPEN                                                               FAULT
|D4OPTMR  DROP4S                                                             D4OPFLT
| T4:104   I:006                                                             B3
|--| |-----|/|----------------------------------------------------------------( )---|
|   DN      07                                                               224
|[47]
B3/224 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  48
Rung #049
|DOOR OPEN                                                     DOOR 5
|SOLENOID                                                      OPEN
|5 ENABLE                                                      TIMER
|DROP5                                                         D5OPTMR
|  O:031                                                       +-TON-------------+
|--| |---------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    01                                                        |TIMER:    T4:105 |
|[2:46]                                                        |BASE (SEC):  1.0 |-(DN)
|                                                              |PRESET:        4 |
|                                                              |ACCUM:         0 |
|                                                              +-----------------+
T4:105.DN - -| |- - File #5 FAULTS -  50
Rung #050
|FAULT
|DETECT                                                                      DOOR 5
|DOOR 5   DOOR 5                                                             OPEN
|OPEN     OPEN                                                               FAULT
|D5OPTMR  DROP5S                                                             D5OPFLT
| T4:105   I:026                                                             B3
|--| |-----|/|----------------------------------------------------------------( )---|
|   DN      01                                                               225
|[49]
```

```
B3/225 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  50
Rung #051
|DOOR OPEN                                                      DOOR 6            |
|SOLENOID                                                       OPEN              |
|6 ENABLE                                                       TIMER             |
|DROP6                                                          D6OPTMR           |
|  O:031                                                        +-TON-----------+ |
|----] [---------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|   03                                                          |TIMER:   T4:106| |
|[2:47]                                                         |BASE (SEC):  1.0|-(DN) |
|                                                               |PRESET:       4| |
|                                                               |ACCUM:        0| |
|                                                               +---------------+ |
T4:106.DN - -] [- - File #5 FAULTS -  52
Rung #052
|FAULT                                                                            |
|DETECT                                                                  DOOR 6   |
|DOOR 6    DOOR 6                                                        OPEN     |
|OPEN      OPEN                                                          FAULT    |
|D6OPTMR   DROP6S                                                        D6OPFLT  |
| T4:106   I:026                                                          B3      |
|----] [-----]/[----------------------------------------------------------( )-----|
|    DN      03                                                           226     |
|[51]                                                                             |
B3/226 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  52
.ng #053
|DOOR OPEN                                                      DOOR 7            |
|SOLENOID                                                       OPEN              |
|7 ENABLE                                                       TIMER             |
|DROP7                                                          D7OPTMR           |
|  O:045                                                        +-TON-----------+ |
|----] [---------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|   01                                                          |TIMER:   T4:107| |
|[2:48]                                                         |BASE (SEC):  1.0|-(DN) |
|                                                               |PRESET:       4| |
|                                                               |ACCUM:        0| |
|                                                               +---------------+ |
T4:107.DN - -] [- - File #5 FAULTS -  54
Rung #054
|FAULT                                                                            |
|DETECT                                                                  DOOR 7   |
|DOOR 7    DOOR 7                                                        OPEN     |
|OPEN      OPEN                                                          FAULT    |
|D7OPTMR   DROP7S                                                        D7OPFLT  |
| T4:107   I:042                                                          B3      |
|----] [-----]/[----------------------------------------------------------( )-----|
|    DN      01                                                           227     |
.53]                                                                              |
B3/227 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  54
Rung #055
|DOOR OPEN                                                      DOOR 8            |
|SOLENOID                                                       OPEN              |
|8 ENABLE                                                       TIMER             |
|DROP8                                                          D8OPTMR           |
|  O:045                                                        +-TON-----------+ |
|----] [---------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|   03                                                          |TIMER:   T4:108| |
|[2:49]                                                         |BASE (SEC):  1.0|-(DN) |
|                                                               |PRESET:       4| |
|                                                               |ACCUM:        0| |
>                                                               >>>>>>>>>>>>>>>>>>   >
```

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```
T4:108.DN - -| |- - File #5 FAULTS - 56
Rung #056
|FAULT                                                            DOOR 8
|DETECT                                                           OPEN
|DOOR 8    DOOR 8                                                 FAULT
|OPEN      OPEN                                                   D8OPFLT
|D8OPTMR   DROP8S                                                 B3
| T4:108    I:042
|--| |------|/|------------------------------------------------------( )--|
|   DN       03                                                   228
|[55]
B3/228 - -|/|- - File #5 FAULTS - 66
         -( )- - File #5 FAULTS - 56
Rung #057
|DOOR OPEN                                           DOOR 9
|SOLENOID                                            OPEN
|9 ENABLE                                            TIMER
|DROP9                                               D9OPTMR
| O:061                                              +-TON-----------------+
|--| |-----------------------------------------------|TIMER ON DELAY       |-(EN)-|
|   01                                               |TIMER:      T4:109   |
|[2:325]                                             |BASE (SEC):    1.0   |-(DN)
|                                                    |PRESET:          4   |
|                                                    |ACCUM:           0   |
|                                                    +---------------------+
   109.DN - -| |- - File #5 FAULTS - 58
Rung #058
|FAULT                                                            DOOR 9
|DETECT                                                           OPEN
|DOOR 9    DOOR 9                                                 FAULT
|OPEN      OPEN                                                   D9OPFLT
|D9OPTMR   DROP9S                                                 B3
| T4:109    I:056
|--| |------|/|------------------------------------------------------( )--|
|   DN       01                                                   229
|[57]
B3/229 - -|/|- - File #5 FAULTS - 66
         -( )- - File #5 FAULTS - 58
Rung #059
|DOOR OPEN                                           DOOR 10
|SOLENOID                                            OPEN
|10 ENABLE                                           TIMER
|DROP10                                             D10OPTMR
| O:061                                              +-TON-----------------+
|--| |-----------------------------------------------|TIMER ON DELAY       |-(EN)-|
|   03                                               |TIMER:      T4:110   |
 [2:326]                                             |BASE (SEC):    1.0   |-(DN)
|                                                    |PRESET:          4   |
|                                                    |ACCUM:           0   |
|                                                    +---------------------+
T4:110.DN - -| |- - File #5 FAULTS - 60
Rung #060
|FAULT                                                            DOOR 10
|DETECT                                                           OPEN
|DOOR 10   DOOR 10                                                FAULT
|OPEN      OPEN                                                   D10OPFLT
|D10OPTMR  DROP10S                                                B3
| T4:110    I:056
|--| |------|/|------------------------------------------------------( )--|
|   DN       03                                                   230
|[59]
```

```
B3/230 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  60
Rung #061
|DOOR OPEN                                                    DOOR 11
|SOLENOID                                                     OPEN
|11 ENABLE                                                    TIMER
|DROP11                                                       D11OPTMR
|  O:061                                                      +-TON-------------+
|---| |-------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|    05                                                       |TIMER:    T4:111|
|[2:327]                                                      |BASE (SEC):  1.0|-(DN)
|                                                             |PRESET:        4|
|                                                             |ACCUM:         0|
|                                                             +-----------------+
T4:111.DN - -| |- - File #5 FAULTS -  62
Rung #062
|FAULT
|DETECT                                                             DOOR 11
|DOOR 11   DOOR 11                                                  OPEN
|OPEN      OPEN                                                     FAULT
|D11OPTMR  DROP11S                                                  D11OPFLT
|  T4:111    I:056                                                    B3
|---| |--------|/|----------------------------------------------------( )---
|    DN         05                                                   231
|[61]
B3/231 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  62
  ng #063
|DOOR OPEN                                                    DOOR 12
|SOLENOID                                                     OPEN
|12 ENABLE                                                    TIMER
|DROP12                                                       D12OPTMR
|  O:061                                                      +-TON-------------+
|---| |-------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|    07                                                       |TIMER:    T4:112|
|[2:351]                                                      |BASE (SEC):  1.0|-(DN)
|                                                             |PRESET:        4|
|                                                             |ACCUM:         0|
|                                                             +-----------------+
T4:112.DN - -| |- - File #5 FAULTS -  64
Rung #064
|FAULT
|DETECT                                                             DOOR 12
|DOOR 12   DOOR 12                                                  OPEN
|OPEN      OPEN                                                     FAULT
|D12OPTMR  DROP12S                                                  D12OPFLT
|  T4:112    I:056                                                    B3
|---| |--------|/|----------------------------------------------------( )---
|    DN         07                                                   232
 53]
B3/232 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  64
Rung #065
|DOOR 1   DOOR 2   DOOR 3   DOOR 4   DOOR 5   DOOR 6   DOOR 7   DOOR 8   DOOR 9   DOOR 10   DOOR 11   DOOR 12      DOOR
|CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED    CLOSED    CLOSED       CLOSED
|FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT     FAULT     FAULT        NO FAULT
|D1CLFLT  D2CLFLT  D3CLFLT  D4CLFLT  D5CLFLT  D6CLFLT  D7CLFLT  D8CLFLT  D9CLFLT  D10CLFLT  D11CLFLT  D12CLFLT     DRCLNOFLT
|  B3       B3       B3       B3       B3       B3       B3       B3       B3       B3        B3        B3           B3
|--|/|------|/|------|/|------|/|------|/|------|/|------|/|------|/|------|/|------|/|-------|/|-------|/|----------( )---
|  201      202      203      204      205      206      207      208      209      210       211       212          213
|[18]     [20]     [22]     [24]     [26]     [28]     [30]     [32]     [34]     [36]      [38]      [40]
B3/213 - -|/|- - File #5 FAULTS -  67
```

616

```
-( )- - File #5 FAULTS - 65
Rung #066
DOOR 1    DOOR 2    DOOR 3    DOOR 4    DOOR 5    DOOR 6    DOOR 7    DOOR 8    DOOR 9    DOOR 10    DOOR 11    DOOR 12    DOOR
OPEN      OPEN      OPEN      OPEN      OPEN      OPEN      OPEN      OPEN      OPEN      OPEN       OPEN       OPEN       OPEN
FAULT     FAULT     FAULT     FAULT     FAULT     FAULT     FAULT     FAULT     FAULT     FAULT      FAULT      FAULT      NO FAULT
D1OPFLT   D2OPFLT   D3OPFLT   D4OPFLT   D5OPFLT   D6OPFLT   D7OPFLT   D8OPFLT   D9OPFLT   D10OPFLT   D11OPFLT   D12OPFLT   DROPNOFLT
B3        B3        B3        B3        B3        B3        B3        B3        B3        B3         B3         B3         B3
-]/[-     -]/[-     -]/[-     -]/[-     -]/[-     -]/[-     -]/[-     -]/[-     -]/[-     -]/[-      -]/[-      -]/[-      -( )-
221       222       223       224       225       226       227       228       229       230        231        232        214
[42]      [44]      [46]      [48]      [50]      [52]      [54]      [56]      [58]      [60]       [62]       [64]
B3/214 - -]/[- - File #5 FAULTS - 67
         -( )- - File #5 FAULTS - 66
Rung #067
DOOR                                                                                   DOOR FAULT
CLOSED                                                                                 DRFLT
NO FAULT                                                                               B3
DRCLNOFLT                                                                              -(L)-
B3                                                                                     215
-]/[-
213
[65]
            B3/215 - -] [- - File #2 MAIN_PRGRM - 625
                     -]/[- - File #2 MAIN_PRGRM - 158
                     -(U)- - File #5 FAULTS - 68
DOOR
OPEN
NO FAULT
DROPNOFLT
B3
-]/[-
214
[66]
Rung #068
PAUSE                                                                                  DOOR FAULT
DISABLE                                                                                DRFLT
TS12                                                                                   B3
N7:16                                                                                  -(U)-
-] [-                                                                                  215
4
[2:3]
B3/215 - -] [- - File #2 MAIN_PRGRM - 625
         -]/[- - File #2 MAIN_PRGRM - 158
         -(L)- - File #5 FAULTS - 67
         -(U)- - File #5 FAULTS - 68
Rung #069
CRYO GATE                                                           CRYO VALVE
HEATER 1                                                            1 OPEN
CHAMBER                                                             TIMER
HV1                                                                 CV1OPTMR
O:011                                                               +-TON--------------+
-] [-                                                               |TIMER ON DELAY    |-(EN)-
11                                                                  |TIMER:       T4:49|
[2:115]                                                             |BASE (SEC):    1.0|-(DN)
                                                                    |PRESET:          7|
                                                                    |ACCUM:           7|
                                                                    +------------------+
T4:49.DN - -] [- - File #5 FAULTS - 70
```

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```
Rung #070
|FAULT         HEATER 1                                                   |
|DETECT        CHAMBER                                         CRYO VALVE |
|CRYO VALVE    GATE VALVE                                      1 OPEN     |
|1 OPEN        OPEN                                            FAULT      |
|CV1OPTMR      HV1S3                                           CV1OPFLT   |
|  T4:49        I:002                                             B3      |
|----] [---------]/[-------------------------------------------------( )---|
|     DN          10                                               251    |
|[69]
B3/251 - -]/[- - File #5 FAULTS -  93
           -( )- - File #5 FAULTS -  70
Rung #071
|CRYO GATE     CRYO GATE                                                  |
|SOLENOID 1    SOLENOID 2                                 CRYO VALVE      |
|HEATER 2      HEATER 2                                   2 OPEN          |
|CHAMBER       CHAMBER                                    TIMER           |
|HV2_1         HV2_2                                      CV2OPTMR        |
|  O:011         O:011                                    +--TON---------+ |
|----] [----------] [--------------------------------------+TIMER ON DELAY+-(EN)-|
|     13            14                                    |TIMER:   T4:50| |
|[2:117]        [2:118]                                   |BASE (SEC): 1.0+-(DN) |
|                                                         |PRESET:      5| |
|                                                         |ACCUM:       0| |
|                                                         +--------------+ |
T4:50.DN - -] [- - File #5 FAULTS -  72
Rung #072
   ILT         HEATER 2                                                   |
|DETECT        CHAMBER                                         CRYO VALVE |
|CRYO VALVE    GATE VALVE                                      2 OPEN     |
|2 OPEN        OPEN                                            FAULT      |
|CV2OPTMR      HV2S3                                           CV2OPFLT   |
|  T4:50        I:004                                             B3      |
|----] [---------]/[-------------------------------------------------( )---|
|     DN          02                                               252    |
|[71]
B3/252 - -]/[- - File #5 FAULTS -  93
           -( )- - File #5 FAULTS -  72
Rung #073
|CRYO GATE     CRYO GATE                                                  |
|SOLENOID 1    SOLENOID 2                                 CRYO VALVE      |
|DWELL 1       DWELL 1                                    3 OPEN          |
|CHAMBER       CHAMBER                                    TIMER           |
|HV3_1         HV3_2                                      CV3OPTMR        |
|  O:011         O:011                                    +--TON---------+ |
|----] [----------] [--------------------------------------+TIMER ON DELAY+-(EN)-|
|     15            16                                    |TIMER:   T4:51| |
|[2:119]        [2:120]                                   |BASE (SEC): 1.0+-(DN) |
|                                                         |PRESET:      5| |
|                                                         |ACCUM:       0| |
|                                                         +--------------+ |
T4:51.DN - -] [- - File #5 FAULTS -  74
Rung #074
|FAULT         DWELL 1                                                    |
|DETECT        CHAMBER                                         CRYO VALVE |
|CRYO VALVE    GATE VALVE                                      3 OPEN     |
|3 OPEN        OPEN                                            FAULT      |
|CV3OPTMR      HV3S3                                           CV3OPFLT   |
|  T4:51        I:004                                             B3      |
|----] [---------]/[-------------------------------------------------( )---|
|     DN          05                                               253    |
|[73]
```

```
B3/253 - -|/|- - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  74
Rung #075
|CRYO GATE    CRYO GATE                                        CRYO VALVE
|SOLENOID 1   SOLENOID 2                                       4 OPEN
|DWELL 2      DWELL 2                                          TIMER
|CHAMBER      CHAMBER                                          CV4OPTMR
|HV4_1        HV4_2                                            +-TON---------------+
|   O:031        O:031                                         |TIMER ON DELAY     |-(EN)-|
|----| |----------| |------------------------------------------|TIMER:       T4:52 |
|     11           12                                          |BASE (SEC):    1.0 |-(DN)
|[2:121]      [2:122]                                          |PRESET:          5 |
|                                                              |ACCUM:           0 |
|                                                              +-------------------+
T4:52.DN - -| |- - File #5 FAULTS -  76
Rung #076
|FAULT        DWELL 2                                               CRYO VALVE
|DETECT       CHAMBER                                               4 OPEN
|CRYO VALVE   GATE VALVE                                            FAULT
|4 OPEN       OPEN                                                  CV4OPFLT
|CV4OPTMR     HV4S3                                                    B3
|   T4:52        I:022
|----| |----------|/|-------------------------------------------------( )----|
|     DN            10                                                 254
|[75]
B3/254 - -|/|- - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  76
Rung #077
|CRYO GATE    CRYO GATE                                        CRYO VALVE
|SOLENOID 1   SOLENOID 2                                       5 OPEN
|HEATER 2     HEATER 2                                         TIMER
|CHAMBER      CHAMBER                                          CV5OPTMR
|HV5_1        HV5_2                                            +-TON---------------+
|   O:031        O:031                                         |TIMER ON DELAY     |-(EN)-|
|----| |----------| |------------------------------------------|TIMER:       T4:53 |
|     13           14                                          |BASE (SEC):    1.0 |-(DN)
|[2:123]      [2:124]                                          |PRESET:          5 |
|                                                              |ACCUM:           0 |
|                                                              +-------------------+
T4:53.DN - -| |- - File #5 FAULTS -  78
Rung #078
|FAULT        HEATER 3                                              CRYO VALVE
|DETECT       CHAMBER                                               5 OPEN
|CRYO VALVE   GATE VALVE                                            FAULT
|5 OPEN       OPEN                                                  CV5OPFLT
|CV5OPTMR     HV5S3                                                    B3
|   T4:53        I:024
|----| |----------|/|-------------------------------------------------( )----|
|     DN            02                                                 255
|[77]
B3/255 - -|/|- - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  78
```

Rung #079

```
|CRYO GATE   CRYO GATE                                        |
|SOLENOID 1  SOLENOID 2                       CRYO VALVE      |
|DWELL 3     DWELL 3                          6 OPEN          |
|CHAMBER     CHAMBER                          TIMER           |
|HV6_1       HV6_2                            CV6OPTMR        |
|  O:031       O:031                          +--TON-----------+
|---] [--------] [----------------------------|TIMER ON DELAY  |-(EN)-|
|    15          16                           |TIMER:     T4:54|      |
|[2:125]     [2:126]                          |BASE (SEC):  1.0|-(DN) |
|                                             |PRESET:        5|      |
|                                             |ACCUM:         0|      |
|                                             +----------------+      |
T4:54.DN - ] [ - File #5 FAULTS - 80
```

Rung #080

```
|FAULT       DWELL 3                                          |
|DETECT      CHAMBER                              CRYO VALVE  |
|CRYO VALVE  GATE VALVE                           6 OPEN      |
|6 OPEN      OPEN                                 FAULT       |
|CV6OPTMR    HV6S3                                CV6OPFLT    |
|  T4:54       I:024                                 B3       |
|---] [--------]/[------------------------------------( )-----|
|    DN          05                                  256      |
|[79]
B3/256 - ]/[ - File #5 FAULTS - 93
       -( )- - File #5 FAULTS - 80
```

Rung #081

```
 'YO GATE    CRYO GATE                                        |
|SOLENOID 1  SOLENOID 2                       CRYO VALVE      |
|DWELL 4     DWELL 4                          7 OPEN          |
|CHAMBER     CHAMBER                          TIMER           |
|HV7_1       HV7_2                            CV7OPTMR        |
|  O:045       O:045                          +--TON-----------+
|---] [--------] [----------------------------|TIMER ON DELAY  |-(EN)-|
|    11          12                           |TIMER:     T4:55|      |
|[2:127]     [2:128]                          |BASE (SEC):  1.0|-(DN) |
|                                             |PRESET:        5|      |
|                                             |ACCUM:         0|      |
|                                             +----------------+      |
T4:55.DN - ] [ - File #5 FAULTS - 82
```

Rung #082

```
|FAULT       DWELL 4                                          |
|DETECT      CHAMBER                              CRYO VALVE  |
|CRYO VALVE  GATE VALVE                           7 OPEN      |
|7 OPEN      OPEN                                 FAULT       |
|CV7OPTMR    HV7S3                                CV7OPFLT    |
|  T4:55       I:036                                 B3       |
|---] [--------]/[------------------------------------( )-----|
|    DN          10                                  257      |
 [81]
B3/257 - ]/[ - File #5 FAULTS - 93
       -( )- - File #5 FAULTS - 82
```

```
Rung #083
|CRYO GATE    CRYO GATE                                          CRYO VALVE                  |
|SOLENOID 1   SOLENOID 2                                         8 OPEN                      |
|BUFFER 3     BUFFER 3                                           TIMER                       |
|CHAMBER      CHAMBER                                            CV8OPTMR                    |
|HV8_1        HV8_2                                              +-TON-----------------+     |
|  O:045       O:045                                             |TIMER ON DELAY       |-(EN)-|
|---] [--------] [-----------------------------------------------|TIMER:         T4:56 |     |
|    13         14                                               |BASE (SEC):     1.0 |-(DN) |
|[2:129]      [2:130]                                            |PRESET:           5 |     |
|                                                                |ACCUM:            0 |     |
|                                                                +---------------------+     |
|
T4:56.DN - ] [ - File #5 FAULTS -  84
Rung #084
|FAULT        BUFFER 3                                                      CRYO VALVE  |
|DETECT       CHAMBER                                                       8 OPEN      |
|CRYO VALVE   GATE VALVE                                                    FAULT       |
|8 OPEN       OPEN                                                          CV8OPFLT    |
|CV8OPTMR     HV8S3                                                           B3        |
|  T4:56       I:040                                                                    |
|---] [--------]/[----------------------------------------------------------( )---------|
|    DN         02                                                            258       |
|[83]
B3/258 - ]/[ - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  84
Rung #085
   YO GATE    CRYO GATE                                          CRYO VALVE                  |
|SOLENOID 1   SOLENOID 2                                         9 OPEN                      |
|DWELL 5      DWELL 5                                            TIMER                       |
|CHAMBER      CHAMBER                                            CV9OPTMR                    |
|HV9_1        HV9_2                                              +-TON-----------------+     |
|  O:045       O:045                                             |TIMER ON DELAY       |-(EN)-|
|---] [--------] [-----------------------------------------------|TIMER:         T4:57 |     |
|    15         16                                               |BASE (SEC):     1.0 |-(DN) |
|[2:131]      [2:132]                                            |PRESET:           5 |     |
|                                                                |ACCUM:            0 |     |
|                                                                +---------------------+     |
|
T4:57.DN - ] [ - File #5 FAULTS -  86
Rung #086
|FAULT        DWELL 5                                                       CRYO VALVE  |
|DETECT       CHAMBER                                                       9 OPEN      |
|CRYO VALVE   GATE VALVE                                                    FAULT       |
|9 OPEN       OPEN                                                          CV9OPFLT    |
|CV9OPTMR     HV9S3                                                           B3        |
|  T4:57       I:040                                                                    |
|---] [--------]/[----------------------------------------------------------( )---------|
|    DN         05                                                            259       |
 [85]
B3/259 - ]/[ - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  86
```

Rung #087

```
|CRYO GATE   CRYO GATE                                               CRYO VALVE            |
|SOLENOID 1  SOLENOID 2                                              10 OPEN               |
|DWELL 6     DWELL 6                                                 TIMER                 |
|CHAMBER     CHAMBER                                                 CV10OPTRM             |
|HV10_1      HV10_2                                                  +--TON---------+      |
|  O:061       O:061                                                 |TIMER ON DELAY|-(EN)-|
|---] [--------] [---------------------------------------------------|TIMER:   T4:58|      |
|    11         12                                                   |BASE (SEC): 1.0|-(DN) |
| [2:133]    [2:134]                                                 |PRESET:      5|      |
|                                                                    |ACCUM:       0|      |
|                                                                    +--------------+      |
T4:58.DN - ] [ - File #5 FAULTS -  88
```

Rung #088

```
|FAULT       DWELL 6                                                       CRYO VALVE |
|DETEC       CHAMBER                                                       10 OPEN    |
|CRYO VALVE  GATE VALVE                                                    FAULT      |
|10 OPEN     OPEN                                                          CV10OPFLT  |
|CV10OPTRM   HV10S3                                                           B3      |
|  T4:58       I:052                                                                  |
|---] [--------]/[-----------------------------------------------------------( )------|
|    DN         10                                                            260     |
|[87]
B3/260 - ]/[ - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  88
```

Rung #089

```
  YO GATE    CRYO GATE                                               CRYO VALVE            |
|SOLENOID 1  SOLENOID 2                                              11 OPEN               |
|BUFFER 4    BUFFER 4                                                TIMER                 |
|CHAMBER     CHAMBER                                                 CV11OPTMR             |
|HV11_1      HV11_2                                                  +--TON---------+      |
|  O:061       O:061                                                 |TIMER ON DELAY|-(EN)-|
|---] [--------] [---------------------------------------------------|TIMER:   T4:59|      |
|    13         14                                                   |BASE (SEC): 1.0|-(DN) |
| [2:135]    [2:136]                                                 |PRESET:      5|      |
|                                                                    |ACCUM:       0|      |
|                                                                    +--------------+      |
T4:59.DN - ] [ - File #5 FAULTS -  90
```

Rung #090

```
|FAULT       BUFFER 4                                                      CRYO VALVE |
|DETECT      CHAMBER                                                       11 OPEN    |
|CRYO VALVE  GATE VALVE                                                    FAULT      |
|11 OPEN     OPEN                                                          CV11OPFLT  |
|CV11OPTMR   HV11S3                                                           B3      |
|  T4:59       I:054                                                                  |
|---] [--------]/[-----------------------------------------------------------( )------|
|    DN         02                                                            261     |
 [89]
B3/261 - ]/[ - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  90
```

622

```
Rung #091
|CRYO GATE    CRYO GATE                                              CRYO VALVE
|SOLENOID 1   SOLENOID 2                                             12 OPEN
|EXBUFFER     EXBUFFER                                               TIMER
|CHAMBER      CHAMBER                                                CV12OPTMR
|HV12_1       HV12_2                                                 +-TON---------------+
|  0:061       0:061                                                 |TIMER ON DELAY     |-(EN)-|
|--] [---------] [---------------------------------------------------|TIMER:        T4:60|
|   15          16                                                   |BASE (SEC):     1.0|-(DN)
|[2:137]      [2:138]                                                |PRESET:           5|
|                                                                    |ACCUM:            0|
|                                                                    +-------------------+
T4:60.DN - ] [ - File #5 FAULTS - 92
Rung #092
|FAULT        EXIT                                                         CRYO VALVE
|DETECT       BUFFER                                                       12 OPEN
|CRYO VALVE   GATE VALVE                                                   FAULT
|12 OPEN      OPEN                                                         CV12OPFLT
|CV12OPTMR    HV12S3                                                          B3
|  T4:60       I:054
|--] [---------]/[---------------------------------------------------------( )---|
|   DN          05                                                           262
|[91]
B3/262 - ]/[ - File #5 FAULTS - 93
       -( )- - File #5 FAULTS - 92
Rung #093
 CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE
 1 OPEN      2 OPEN      3 OPEN      4 OPEN      5 OPEN      6 OPEN      7 OPEN      8 OPEN      9 OPEN      10 OPEN
|FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT
|CV1OPFLT    CV2OPFLT    CV3OPFLT    CV4OPFLT    CV5OPFLT    CV6OPFLT    CV7OPFLT    CV8OPFLT    CV9OPFLT    CV10OPFLT
|   B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|---]/[-------]/[-------]/[-------]/[-------]/[-------]/[-------]/[-------]/[-------]/[-------]/[---
|   251         252         253         254         255         256         257         258         259         260
|[70]        [72]        [74]        [76]        [78]        [80]        [82]        [84]        [86]        [88]
                                                                           CRYO VALVE  CRYO VALVE
                                                                           11 OPEN     12 OPEN     CRYO VALVE
                                                                           FAULT       FAULT       OPEN FAULT
                                                                           CV11OPFLT   CV12OPFLT   CVOPFLT
                                                                              B3          B3          B3
                                                                          ---]/[-------]/[---------( )---|
                                                                              261         262         312
                                                                           [90]        [92]
B3/312 - ]/[ - File #5 FAULTS - 142
       -( )- - File #5 FAULTS - 93
Rung #094
|CRYO GATE    CRYO GATE                                              CRYO VALVE
|SOLENOID 1   SOLENOID 2                                             2 THROTTLE
|HEATER 2     HEATER 2                                               TIMER
|CHAMBER      CHAMBER                                                CV2THTMR
|HV2_1        HV2_2                                                  +-TON---------------+
|  0:011       0:011                                                 |TIMER ON DELAY     |-(EN)-|
|--]/[---------] [---------------------------------------------------|TIMER:       T4:114|
|   13          14                                                   |BASE (SEC):     1.0|-(DN)
|[2:117]      [2:118]                                                |PRESET:           5|
|                                                                    |ACCUM:            5|
|                                                                    +-------------------+
T4:114.DN - ] [ - File #5 FAULTS - 95
```

```
Rung #095
|FAULT        HEATER 2                                          CRYO VALVE  |
|DETECT       CHAMBER                                           2 THROTTLE  |
|CRYO VALVE   GATE VALVE                                        FAULT       |
|2 THROTTLE   THROTTLED                                         CV2THFLT    |
|CV2THTMR     HV2S2                                                B3       |
|  T4:114      I:004                                                        |
|----] [---------]/[----------------------------------------------( )-------|
|    DN          01                                                234      |
|[94]
B3/234 - ]/[ - File #5 FAULTS -  116
       -( )- - File #5 FAULTS -  95
Rung #096
|CRYO GATE    CRYO GATE                                                       |
|SOLENOID 1   SOLENOID 2                                 CRYO VALVE           |
|DWELL 1      DWELL 1                                    3 THROTTLE           |
|CHAMBER      CHAMBER                                    TIMER                |
|HV3_1        HV3_2                                      CV3THTMR             |
|  O:011        O:011                                    +-TON-------------+  |
|----]/[---------] [-------------------------------------+TIMER ON DELAY   +-(EN)-|
|     15          16                                     |TIMER:    T4:115|   |
|[2:119]      [2:120]                                    |BASE (SEC):  1.0+-(DN)|
|                                                        |PRESET:        5|   |
|                                                        |ACCUM:         5|   |
|                                                        +-----------------+  |
T4:115.DN - ] [ - File #5 FAULTS -  97
Rung #097
|FAULT        DWELL 1                                           CRYO VALVE  |
|DETECT       CHAMBER                                           3 THROTTLE  |
|CRYO VALVE   GATE VALVE                                        FAULT       |
|3 THROTTLE   THROTTLED                                         CV3THFLT    |
|CV3THTMR     HV3S2                                                B3       |
|  T4:115      I:004                                                        |
|----] [---------]/[----------------------------------------------( )-------|
|    DN          04                                                235      |
|[96]
B3/235 - ]/[ - File #5 FAULTS -  116
       -( )- - File #5 FAULTS -  97
Rung #098
|CRYO GATE    CRYO GATE                                                       |
|SOLENOID 1   SOLENOID 2                                 CRYO VALVE           |
|DWELL 2      DWELL 2                                    4 THROTTLE           |
|CHAMBER      CHAMBER                                    TIMER                |
|HV4_1        HV4_2                                      CV4THTMR             |
|  O:031        O:031                                    +-TON-------------+  |
|----]/[---------] [-------------------------------------+TIMER ON DELAY   +-(EN)-|
|     11          12                                     |TIMER:    T4:116|   |
|[2:121]      [2:122]                                    |BASE (SEC):  1.0+-(DN)|
|                                                        |PRESET:        5|   |
|                                                        |ACCUM:         5|   |
|                                                        +-----------------+  |
T4:116.DN - ] [ - File #5 FAULTS -  99
Rung #099
|FAULT        DWELL 2                                           CRYO VALVE  |
|DETECT       CHAMBER                                           4 THROTTLE  |
|CRYO VALVE   GATE VALVE                                        FAULT       |
|4 THROTTLE   THROTTLED                                         CV4THFLT    |
|CV4THTMR     HV4S2                                                B3       |
|  T4:116      I:022                                                        |
|----] [---------]/[----------------------------------------------( )-------|
|    DN          07                                                236      |
|[98]
```

624

```
B3/236 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  99
Rung #100
|CRYO GATE    CRYO GATE                                                                            |
|SOLENOID 1   SOLENOID 2                                                         CRYO VALVE        |
|HEATER 2     HEATER 2                                                           5 THROTTLE        |
|CHAMBER      CHAMBER                                                            TIMER             |
|HV5_1        HV5_2                                                              CVSTHTMR          |
|   O:031         O:031                                                          +-TON----------+  |
|----|/|-----------| |-----------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|     13            14                                                           |TIMER:  T4:117|  |
|[2:123]      [2:124]                                                            |BASE (SEC): 1.0|-(DN) |
|                                                                                |PRESET:      5|  |
|                                                                                |ACCUM:       5|  |
|                                                                                +--------------+  |
T4:117.DN - -| |- - File #5 FAULTS -  101
Rung #101
|FAULT        HEATER 3                                                                  |
|DETECT       CHAMBER                                                        CRYO VALVE |
|CRYO VALVE   GATE VALVE                                                     5 THROTTLE |
|5 THROTTLE   THROTTLED                                                      FAULT      |
|CVSTHTMR     HV5S2                                                          CVSTHFLT   |
|  T4:117        I:024                                                           B3     |
|-----| |-----------|/|---------------------------------------------------------( )------|
|      DN           01                                                           237    |
|[100]
B3/237 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  101
ung #102
|CRYO GATE    CRYO GATE                                                                            |
|SOLENOID 1   SOLENOID 2                                                         CRYO VALVE        |
|DWELL 3      DWELL 3                                                            6 THROTTLE        |
|CHAMBER      CHAMBER                                                            TIMER             |
|HV6_1        HV6_2                                                              CV6THTMR          |
|   O:031         O:031                                                          +-TON----------+  |
|----|/|-----------| |-----------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|     15            16                                                           |TIMER:  T4:118|  |
|[2:125]      [2:126]                                                            |BASE (SEC): 1.0|-(DN) |
|                                                                                |PRESET:      5|  |
|                                                                                |ACCUM:       5|  |
|                                                                                +--------------+  |
T4:118.DN - -| |- - File #5 FAULTS -  103
Rung #103
|FAULT        DWELL 3                                                                   |
|DETECT       CHAMBER                                                        CRYO VALVE |
|CRYO VALVE   GATE VALVE                                                     6 THROTTLE |
|6 THROTTLE   THROTTLED                                                      FAULT      |
|CV6THTMR     HV6S2                                                          CV6THFLT   |
|  T4:118        I:024                                                           B3     |
 -----| |-----------|/|---------------------------------------------------------( )------|
      DN           04                                                            238    |
|[102]
B3/238 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  103
```

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```
Rung #104
|CRYO GATE    CRYO GATE                                         CRYO VALVE
|SOLENOID 1   SOLENOID 2                                        7 THROTTLE
|DWELL 4      DWELL 4                                           TIMER
|CHAMBER      CHAMBER                                           CV7THTMR
|HV7_1        HV7_2                                             +--TON-----------------+
|  0:045        0:045                                           |                      |
|---|/|--------| |----------------------------------------------+TIMER ON DELAY        +-(EN)-
|   11          12                                              |TIMER:        T4:119  |
|[2:127]      [2:128]                                           |BASE (SEC):      1.0  +-(DN)
|                                                               |PRESET:           5   |
|                                                               |ACCUM:            5   |
|                                                               +----------------------+
T4:119.DN - -| |- - File #5 FAULTS -  105
Rung #105
|FAULT        DWELL 4                                                       CRYO VALVE
|DETECT       CHAMBER                                                       7 THROTTLE
|CRYO VALVE   GATE VALVE                                                    FAULT
|7 THROTTLE   THROTTLED                                                     CV7THFLT
|CV7THTMR     HV7S2                                                            B3
|  T4:119       I:036
|---| |--------|/|--------------------------------------------------------------( )----
|    DN         07                                                             239
|[104]
B3/239 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  105
Rung #106
|CRYO GATE    CRYO GATE                                         CRYO VALVE
|SOLENOID 1   SOLENOID 2                                        8 THROTTLE
|BUFFER 3     BUFFER 3                                          TIMER
|CHAMBER      CHAMBER                                           CV8THTMR
|HV8_1        HV8_2                                             +--TON-----------------+
|  0:045        0:045                                           |                      |
|---|/|--------| |----------------------------------------------+TIMER ON DELAY        +-(EN)-
|   13          14                                              |TIMER:        T4:120  |
|[2:129]      [2:130]                                           |BASE (SEC):      1.0  +-(DN)
|                                                               |PRESET:           5   |
|                                                               |ACCUM:            5   |
|                                                               +----------------------+
T4:120.DN - -| |- - File #5 FAULTS -  107
Rung #107
|FAULT        BUFFER 3                                                      CRYO VALVE
|DETECT       CHAMBER                                                       8 THROTTLE
|CRYO VALVE   GATE VALVE                                                    FAULT
|8 THROTTLE   THROTTLED                                                     CV8THFLT
|CV8THTMR     HV8S2                                                            B3
|  T4:120       I:040
|---| |--------|/|--------------------------------------------------------------( )----
|    DN         01                                                             240
|[106]
B3/240 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  107
```

```
Rung #108
|CRYO GATE   CRYO GATE                                         CRYO VALVE                  |
|SOLENOID 1  SOLENOID 2                                        9 THROTTLE                  |
|DWELL 5     DWELL 5                                           TIMER                       |
|CHAMBER     CHAMBER                                           CV9THTMR                    |
|HV9_1       HV9_2                                             +-TON-----------------+     |
|  O:045       O:045                                           |TIMER ON DELAY       |-(EN)-|
|---|/|--------| |---------------------------------------------|TIMER:        T4:121 |     |
|    15         16                                             |BASE (SEC):      1.0 |-(DN) |
|[2:131]     [2:132]                                           |PRESET:            5 |     |
|                                                              |ACCUM:             5 |     |
|                                                              +---------------------+     |
|
T4:121.DN - -| |- - File #5 FAULTS -  109
Rung #109
|FAULT        DWELL 5                                                        CRYO VALVE |
|DETECT       CHAMBER                                                        9 THROTTLE |
|CRYO VALVE   GATE VALVE                                                     FAULT      |
|9 THROTTLE   THROTTLED                                                      CV9THFLT   |
|CV9THTMR     HV9S2                                                              B3     |
|  T4:121       I:040                                                                   |
|---| |----------|/|--------------------------------------------------------------( )----|
|    DN           04                                                              241   |
|[108]
B3/241 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  109
R~ng #110
   O GATE    CRYO GATE                                         CRYO VALVE                  |
|SOLENOID 1  SOLENOID 2                                        10THROTTLE                  |
|DWELL 6     DWELL 6                                           TIMER                       |
|CHAMBER     CHAMBER                                           CV10THTMR                   |
|HV10_1      HV10_2                                            +-TON-----------------+     |
|  O:061       O:061                                           |TIMER ON DELAY       |-(EN)-|
|---| |----------|/|-------------------------------------------|TIMER:        T4:122 |     |
|    11          12                                            |BASE (SEC):      1.0 |-(DN) |
|[2:133]     [2:134]                                           |PRESET:            5 |     |
|                                                              |ACCUM:             0 |     |
|                                                              +---------------------+     |
|
T4:122.DN - -| |- - File #5 FAULTS -  111
Rung #111
|FAULT        DWELL 6                                                        CRYO VALVE |
|DETECT       CHAMBER                                                        10THROTTLE |
|CRYO VALVE   GATE VALVE                                                     FAULT      |
|10THROTTLE   THROTTLED                                                      CV10THFLT  |
|CV10THTMR    HV10S2                                                             B3     |
|  T4:122       I:052                                                                   |
|---| |----------|/|--------------------------------------------------------------( )----|
     DN           07                                                              242   |
 .10]
B3/242 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  111
```

627

Rung #112

```
|CRYO GATE    CRYO GATE                                   CRYO VALVE
|SOLENOID 1   SOLENOID 2                                  11THROTTLE
|BUFFER 4     BUFFER 4                                    TIMER
|CHAMBER      CHAMBER                                     CV11THTMR
|HV11_1       HV11_2                                      +-TON----------------+
|  O:061        O:061                                     |TIMER ON DELAY      |-(EN)-
|---|/|---------| |---------------------------------------|TIMER:      T4:123  |
|    13          14                                       |BASE (SEC):    1.0  |-(DN)
|[2:135]      [2:136]                                     |PRESET:          5  |
|                                                         |ACCUM:           5  |
|                                                         +--------------------+
T4:123.DN - -| |- - File #5 FAULTS -  113
```

Rung #113

```
|FAULT        BUFFER 4                                    CRYO VALVE
|DETECT       CHAMBER                                     11THROTTLE
|CRYO VALVE   GATE VALVE                                  FAULT
|11THROTTLE   THROTTLED                                   CV11THFLT
|CV11THTMR    HV11S2                                         B3
|  T4:123       I:054
|---| |---------|/|------------------------------------------( )---
|    DN          01                                          243
|[112]
B3/243 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  113
```

Rung #114

```
  YO GATE     CRYO GATE                                   CRYO VALVE
|SOLENOID 1   SOLENOID 2                                  12THROTTLE
|EXBUFFER     EXBUFFER                                    TIMER
|CHAMBER      CHAMBER                                     CV12THTMR
|HV12_1       HV12_2                                      +-TON----------------+
|  O:061        O:061                                     |TIMER ON DELAY      |-(EN)-
|---|/|---------| |---------------------------------------|TIMER:      T4:124  |
|    15          16                                       |BASE (SEC):    1.0  |-(DN)
|[2:137]      [2:138]                                     |PRESET:          5  |
|                                                         |ACCUM:           5  |
|                                                         +--------------------+
T4:124.DN - -| |- - File #5 FAULTS -  115
```

Rung #115

```
|FAULT        EXIT                                        CRYO VALVE
|DETECT       BUFFER                                      12THROTTLE
|CRYO VALVE   GATE VALVE                                  FAULT
|12THROTTLE   THROTTLED                                   CV12THFLT
|CV12THTMR    HV12S2                                         B3
|  T4:124       I:054
|---| |---------|/|------------------------------------------( )---
     DN          04                                          244
 14]
B3/244 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  115
```

Rung #116

```
|CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE
|2 THROTTLE  3 THROTTLE  4 THROTTLE  5 THROTTLE  6 THROTTLE  7 THROTTLE  8 THROTTLE  9 THROTTLE  10THROTTLE  11THROTTLE
|FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT
|CV2THFLT    CV3THFLT    CV4THFLT    CV5THFLT    CV6THFLT    CV7THFLT    CV8THFLT    CV9THFLT    CV10THFLT   CV11THFLT
|   B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|---|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---
|   234         235         236         237         238         239         240         241         242         243
|[95]        [97]        [99]        [101]       [103]       [105]       [107]       [109]       [111]       [113]
                                                                                    CRYO VALVE  CRYO VALVE
                                                                                    12THROTTLE  THROTTLE
```

```
                                                   FAULT        FAULT
                                                   CV12THFLT    CVTHFLT
                                                      B3           B3
                                                 ----|/|---------( )----
                                                     244          311
                                                   [115]

B3/311 - -|/|- - File #5 FAULTS -  142
         -( )- - File #5 FAULTS -  116
```

Rung #117

```
|CRYO GATE                                         CYRO VALVE
|HEATER 1                                          1 CLOSE
|CHAMBER                                           TIMER
|HV1                                               CV1CLTMR
|                                                  +-TON-----------------+
|   O:011                                          |TIMER ON DELAY       |-(EN)-
|---|/|--------------------------------------------|TIMER:       T4:131  |
|    11                                            |BASE (SEC):     1.0  |-(DN)
|[2:115]                                           |PRESET:           7  |
|                                                  |ACCUM:            0  |
|                                                  +---------------------+

T4:131.DN - -| |- - File #5 FAULTS -  118
```

Rung #118

```
|FAULT        HEATER 1                                        CRYO VALVE
|DETECT       CHAMBER                                         1 CLOSE
|CRYO VALVE   GATE VALVE                                      FAULT
|1 CLOSE      CLOSE                                           CV1CLFLT
 1CLTMR       HV1S1                                              B3
|  T4:131      I:002
|---| |---------|/|---------------------------------------------( )---
|    DN          06                                             151
|[117]
B3/151 - -|/|- - File #5 FAULTS -. 141
         -( )- - File #5 FAULTS -  118
```

Rung #119

```
|CRYO GATE    CRYO GATE                            CRYO VALVE
|SOLENOID 1   SOLENOID 2                           2 CLOSE
|HEATER 2     HEATER 2                             TIMER
|CHAMBER      CHAMBER                              CV2CLTMR
|HV2_1        HV2_2                                +-TON-----------------+
|  O:011        O:011                              |TIMER ON DELAY       |-(EN)-
|---|/|---------|/|--------------------------------|TIMER:       T4:132  |
|    13          14                                |BASE (SEC):     1.0  |-(DN)
|[2:117]      [2:118]                              |PRESET:           5  |
|                                                  |ACCUM:            0  |
|                                                  +---------------------+

T4:132.DN - -| |- - File #5 FAULTS -  120
```

Rung #120

```
 AULT         HEATER 2                                        CRYO VALVE
|DETECT       CHAMBER                                         2 CLOSE
|CRYO VALVE   GATE VALVE                                      FAULT
|2 CLOSE      CLOSE                                           CV2CLFLT
|CV2CLTMR     HV2S1                                              B3
|  T4:132      I:004
|---| |---------|/|---------------------------------------------( )---
|    DN          00                                             152
|[119]
B3/152 - -|/|- - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  120
```

```
Rung #121
|CRYO GATE   CRYO GATE                                                              |
|SOLENOID 1  SOLENOID 2                                              CRYO VALVE     |
|DWELL 1     DWELL 1                                                 3 CLOSE        |
|CHAMBER     CHAMBER                                                 TIMER          |
|HV3_1       HV3_2                                                   CV3CLTMR       |
|  O:011       O:011                                                 +-TON---------+ |
|---|/|---------|/|--------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   15          16                                                   |TIMER:  T4:133| |
|[2:119]     [2:120]                                                 |BASE (SEC): 1.0|-(DN)|
|                                                                    |PRESET:      5| |
|                                                                    |ACCUM:       0| |
|                                                                    +--------------+ |
T4:133.DN - ┤ ├ - File #5 FAULTS -  122
Rung #122
|FAULT       DWELL 1                                                                |
|DETECT      CHAMBER                                                 CRYO VALVE     |
|CRYO VALVE  GATE VALVE                                              3 CLOSED       |
|3 CLOSE     CLOSED                                                  FAULT          |
|CV3CLTMR    HV3S1                                                   CV3CLFLT       |
|  T4:133      I:004                                                     B3         |
|---] [---------|/|------------------------------------------------------( )--------|
|   DN          03                                                       153        |
|[121]                                                                              |
B3/153 - ┤/├ - File #5 FAULTS -  141
       -( )- - File #5 FAULTS -  122
Rung #123
 CRYO GATE   CRYO GATE                                                              |
|SOLENOID 1  SOLENOID 2                                              CRYO VALVE     |
|DWELL 2     DWELL 2                                                 4 CLOSE        |
|CHAMBER     CHAMBER                                                 TIMER          |
|HV4_1       HV4_2                                                   DV4CLFLT       |
|  O:031       O:031                                                 +-TON---------+ |
|---|/|---------|/|--------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   11          12                                                   |TIMER:  T4:134| |
|[2:121]     [2:122]                                                 |BASE (SEC): 1.0|-(DN)|
|                                                                    |PRESET:      5| |
|                                                                    |ACCUM:       0| |
|                                                                    +--------------+ |
T4:134.DN - ┤ ├ - File #5 FAULTS -  124
Rung #124
|FAULT       DWELL 2                                                                |
|DETECT      CHAMBER                                                 CRYO VALVE     |
|CRYO VALVE  GATE VALVE                                              4 CLOSE        |
|4 CLOSE     CLOSED                                                  FAULT          |
|DV4CLFLT    HV4S1                                                   CV4CLFLT       |
|  T4:134      I:022                                                     B3         |
|---] [---------|/|------------------------------------------------------( )--------|
|   DN          06                                                       154        |
 [123]                                                                              |
B3/154 - ┤/├ - File #5 FAULTS -  141
       -( )- - File #5 FAULTS -  124
```

```
Rung #125
|CRYO GATE    CRYO GATE                                          CRYO VALVE              |
|SOLENOID 1   SOLENOID 2                                         5 CLOSE                 |
|HEATER 2     HEATER 2                                           TIMER                   |
|CHAMBER      CHAMBER                                            CVSCLTRM                |
|HV5_1        HV5_2                                              ┌─TON──────────────┐    |
|  0:031       0:031                                             |TIMER ON DELAY    ├─(EN)─|
├──┤/├─────────┤/├───────────────────────────────────────────────┤TIMER:     T4:135|      |
|   13          14                                               |BASE (SEC):  1.0├─(DN)  |
|[2:123]      [2:124]                                            |PRESET:        5|      |
|                                                                |ACCUM:         0|      |
|                                                                └──────────────────┘    |
|
T4:135.DN - ┤ ├ - File #5 FAULTS - 126
```

```
Rung #126
|FAULT        HEATER 3                                              CRYO VALVE |
|DETECT       CHAMBER                                               5 CLOSE    |
|CRYO VALVE   GATE VALVE                                            FAULT      |
|5 CLOSE      CLOSED                                                CVSCLFLT   |
|CVSCLTRM     HV5S1                                                   B3       |
|  T4:135      I:024                                                           |
├───┤ ├────────┤/├────────────────────────────────────────────────────( )──────┤
|    DN          00                                                  155       |
|[125]
B3/155 - ┤/├ - File #5 FAULTS - 141
       ─( )─ - File #5 FAULTS - 126
```

```
Rung #127
 YO GATE      CRYO GATE                                          CRYO VALVE              |
 .LENOID 1    SOLENOID 2                                         6 CLOSE                 |
|DWELL 3      DWELL 3                                            TIMER                   |
|CHAMBER      CHAMBER                                            CV6CLTMR                |
|HV6_1        HV6_2                                              ┌─TON──────────────┐    |
|  0:031       0:031                                             |TIMER ON DELAY    ├─(EN)─|
├──┤/├─────────┤/├───────────────────────────────────────────────┤TIMER:     T4:136|      |
|   15          16                                               |BASE (SEC):  1.0├─(DN)  |
|[2:125]      [2:126]                                            |PRESET:        5|      |
|                                                                |ACCUM:         0|      |
|                                                                └──────────────────┘    |
|
T4:136.DN - ┤ ├ - File #5 FAULTS - 128
```

```
Rung #128
|FAULT        DWELL 3                                               CRYO VALVE |
|DETECT       CHAMBER                                               6 CLOSE    |
|CRYO VALVE   GATE VALVE                                            FAULT      |
|6 CLOSE      CLOSED                                                CV6CLFLT   |
|CV6CLTMR     HV6S1                                                   B3       |
|  T4:136      I:024                                                           |
├───┤ ├────────┤/├────────────────────────────────────────────────────( )──────┤
|    DN          03                                                  156       |
 '27]
 ,156 - ┤/├ - File #5 FAULTS - 141
       ─( )─ - File #5 FAULTS - 128
```

```
Rung #129
|CRYO GATE    CRYO GATE                                                          |
|SOLENOID 1   SOLENOID 2                                          CRYO VALVE     |
|DWELL 4      DWELL 4                                             7 CLOSE        |
|CHAMBER      CHAMBER                                             TIMER          |
|HV7_1        HV7_2                                               CV7CLTMR       |
|   O:045        O:045                                            +--TON--------+|
|----]/[---------]/[----------------------------------------------|TIMER ON DELAY|-(EN)-|
|     11           12                                             |TIMER:  T4:137|      |
|[2:127]      [2:128]                                             |BASE (SEC): 1.0|-(DN) |
|                                                                 |PRESET:      5|      |
|                                                                 |ACCUM:       0|      |
|                                                                 +--------------+      |
T4:137.DN - ] [ - File #5 FAULTS - 130
```

```
Rung #130
|FAULT        DWELL 4                                                            |
|DETECT       CHAMBER                                                CRYO VALVE  |
|CRYO VALVE   GATE VALVE                                             7 CLOSE     |
|7 CLOSE      CLOSED                                                 FAULT       |
|CV7CLTMR     HV7S1                                                  DV7CLFLT    |
|  T4:137       I:036                                                   B3       |
|----] [----------]/[------------------------------------------------( )---------|
|     DN           06                                                  157       |
|[129]                                                                           |
B3/157 - ]/[ - File #5 FAULTS - 141
       -( )- - File #5 FAULTS - 130
```

```
Rung #131
 YO GATE      CRYO GATE                                                          |
|SOLENOID 1   SOLENOID 2                                          CRYO VALVE     |
|BUFFER 3     BUFFER 3                                            8 CLOSE        |
|CHAMBER      CHAMBER                                             TIMER          |
|HV8_1        HV8_2                                               CV8CLTMR       |
|   O:045        O:045                                            +--TON--------+|
|----]/[---------]/[----------------------------------------------|TIMER ON DELAY|-(EN)-|
|     13           14                                             |TIMER:  T4:138|      |
|[2:129]      [2:130]                                             |BASE (SEC): 1.0|-(DN) |
|                                                                 |PRESET:      5|      |
|                                                                 |ACCUM:       0|      |
|                                                                 +--------------+      |
T4:138.DN - ] [ - File #5 FAULTS - 132
```

```
Rung #132
|FAULT        BUFFER 3                                                           |
|DETECT       CHAMBER                                                CRYO VALVE  |
|CRYO VALVE   GATE VALVE                                             8 CLOSE     |
|8 CLOSE      CLOSED                                                 FAULT       |
|CV8CLTMR     HV8S1                                                  CV8CLFLT    |
|  T4:138       I:040                                                   B3       |
|----] [----------]/[------------------------------------------------( )---------|
      DN           00                                                  158       |
 [131]                                                                           |
B3/158 - ]/[ - File #5 FAULTS - 141
       -( )- - File #5 FAULTS - 132
```

Rung #133
```
|CRYO GATE   CRYO GATE                                                   CRYO VALVE
|SOLENOID 1  SOLENOID 2                                                  9 CLOSE
|DWELL 5     DWELL 5                                                     TIMER
|CHAMBER     CHAMBER                                                     CV9CLTMR
|HV9_1       HV9_2                                                       +--TON-----------------+
|  O:045       O:045                                                     |                      |
|---]/[--------]/[-------------------------------------------------------+TIMER ON DELAY        +-(EN)-
|   15          16                                                       |TIMER:        T4:139  |
|[2:131]     [2:132]                                                     |BASE (SEC):   1.0     +-(DN)
|                                                                        |PRESET:         5     |
|                                                                        |ACCUM:          0     |
|                                                                        +----------------------+
T4:139.DN - ] [ - File #5 FAULTS - 134
```

Rung #134
```
|FAULT       DWELL 5                                                        CRYO VALVE
|DETECT      CHAMBER                                                        9 CLOSE
|CRYO VALVE  GATE VALVE                                                     FAULT
|9 CLOSE     CLOSED                                                         CV9CLFLT
|CV9CLTMR    HV9S1                                                             B3
|  T4:139      I:040
|---] [--------]/[----------------------------------------------------------( )---
|    DN          03                                                           159
|[133]
B3/159 - ]/[ - File #5 FAULTS - 141
         -( )- - File #5 FAULTS - 134
```

Rung #135
```
|CRYO GATE   CRYO GATE                                                   CRYO VALVE
|SOLENOID 1  SOLENOID 2                                                  10 CLOSE
|DWELL 6     DWELL 6                                                     TIMER
|CHAMBER     CHAMBER                                                     CV10CLTMR
|HV10_1      HV10_2                                                      +--TON-----------------+
|  O:061       O:061                                                     |                      |
|---]/[--------]/[-------------------------------------------------------+TIMER ON DELAY        +-(EN)-
|   11          12                                                       |TIMER:        T4:140  |
|[2:133]     [2:134]                                                     |BASE (SEC):   1.0     +-(DN)
|                                                                        |PRESET:         5     |
|                                                                        |ACCUM:          0     |
|                                                                        +----------------------+
T4:140.DN - ] [ - File #5 FAULTS - 136
```

Rung #136
```
|FAULT       DWELL 6                                                        CRYO VALVE
|DETECT      CHAMBER                                                        10 CLOSE
|CRYO VALVE  GATE VALVE                                                     FAULT
|10 CLOSE    CLOSED                                                         CV10CLFLT
|CV10CLTMR   HV10S1                                                            B3
|  T4:140      I:052
|---] [--------]/[----------------------------------------------------------( )---
|    DN          06                                                           160
|[135]
B3/160 - ]/[ - File #5 FAULTS - 141
         -( )- - File #5 FAULTS - 136
```

```
Rung #137
|CRYO GATE    CRYO GATE                                              CRYO VALVE
|SOLENOID 1   SOLENOID 2                                             11 CLOSE
|BUFFER 4     BUFFER 4                                               TIMER
|CHAMBER      CHAMBER                                                CV11CLTMR
|HV11_1       HV11_2                                                 +--TON----------------+
|  0:061        0:061                                                |TIMER ON DELAY       +-(EN)-
+---]/[---------]/[--------------------------------------------------+TIMER:      T4:141  |
|   13           14                                                  |BASE (SEC):   1.0  +-(DN)
|[2:135]      [2:136]                                                |PRESET:         5  |
|                                                                    |ACCUM:          0  |
|                                                                    +---------------------+
T4:141.DN - ] [ - File #5 FAULTS - 138
Rung #138
|FAULT        BUFFER 4                                                          CRYO VALVE
|DETECT       CHAMBER                                                           11 CLOSE
|CRYO VALVE   GATE VALVE                                                        FAULT
|11 CLOSE     CLOSED                                                            CV11CLFLT
|CV11CLTMR    HV11S1                                                               B3
|  T4:141       1:054                                                                     
+---] [---------]/[--------------------------------------------------------------( )---
|   DN           00                                                                161
|[137]
B3/161 - ]/[ - File #5 FAULTS - 141
         ( ) - File #5 FAULTS - 138
Rung #139
|CRYO GATE    CRYO GATE                                              CRYO VALVE
|SOLENOID 1   SOLENOID 2                                             12 CLOSE
|EXBUFFER     EXBUFFER                                               TIMER
|CHAMBER      CHAMBER                                                CV12CLTMR
|HV12_1       HV12_2                                                 +--TON----------------+
|  0:061        0:061                                                |TIMER ON DELAY       +-(EN)-
+---]/[---------]/[--------------------------------------------------+TIMER:      T4:142  |
|   15           16                                                  |BASE (SEC):   1.0  +-(DN)
|[2:137]      [2:138]                                                |PRESET:         5  |
|                                                                    |ACCUM:          0  |
|                                                                    +---------------------+
T4:142.DN - ] [ - File #5 FAULTS - 140
Rung #140
|FAULT        EXITLOCK                                                          CRYO VALVE
|DETECT       CHAMBER                                                           12 CLOSE
|CRYO VALVE   GATE VALVE                                                        FAULT
|12 CLOSE     CLOSED                                                            CV12CLFLT
|CV12CLTMR    HV12S1                                                               B3
|  T4:142       1:054
+---] [---------]/[--------------------------------------------------------------( )---
|   DN           03                                                                162
|[139]
B3/162 - ]/[ - File #5 FAULTS - 141
         ( ) - File #5 FAULTS - 140
Rung #141
|CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE CRYO VALVE
|1 CLOSE    2 CLOSE    3 CLOSED   4 CLOSE    5 CLOSE    6 CLOSE    7 CLOSE    8 CLOSE    9 CLOSE    10 CLOSE
|FAULT      FAULT      FAULT      FAULT      FAULT      FAULT      FAULT      FAULT      FAULT      FAULT
|CV1CLFLT   CV2CLFLT   CV3CLFLT   CV4CLFLT   CV5CLFLT   CV6CLFLT   DV7CLFLT   CV8CLFLT   CV9CLFLT   CV10CLFLT
|   B3         B3         B3         B3         B3         B3         B3         B3         B3         B3
+---]/[--------]/[--------]/[--------]/[--------]/[--------]/[--------]/[--------]/[--------]/[--------]/[---
|   151        152        153        154        155        156        157        158        159        160
|[118]      [120]      [122]      [124]      [126]      [128]      [130]      [132]      [134]      [136]
                                                                         CRYO VALVE  CRYO VALVE  CRYO VALVE
                                                                         11 CLOSE    12 CLOSE    CLOSE
```

```
                                                                    FAULT       FAULT       FAULT      |
                                                                    CV11CLFLT   CV12CLFLT   CVCLFLT    |
                                                                       B3          B3          B3      |
                                                                    ---|/|---------|/|---------( )-----|
                                                                      161         162         313      |
                                                                    [138]       [140]                  |
B3/313 - -|/|- - File #5 FAULTS -  142
         -( )- - File #5 FAULTS -  141
Rung #142
|CRYO VALVE                CRYO VALVE                                                                  |
|THROTTLE     CRYO VALVE   CLOSE                                                         HIVAC VALVE   |
|FAULT        OPEN FAULT   FAULT                                                         FAULT         |
|CVTHFLT      CVOPFLT      CVCLFLT                                                       HVFLT         |
|   B3           B3           B3                                                            B3         |
|---|/|----------|/|----------|/|-----------------------------------------------------------(L)--------|
|   311          312          313                                                           245        |
|[116]        [93]         [141]                                                                       |
B3/245 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  142
         -(U)- - File #5 FAULTS -  143
Rung #143
|PAUSE                                                                                   HIVAC VALVE   |
|DISABLE                                                                                 FAULT         |
|TS12                                                                                    HVFLT         |
|  N7:16                                                                                    B3         |
|---| |-------------------------------------------------------------------------------------(U)--------|
|    4                                                                                      245        |
|[2:3]                                                                                                 |
B3/245 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  142
         -(U)- - File #5 FAULTS -  143
Rung #144
|                                                                           OPEN                       |
|OPEN                                                                       CHAMBER                    |
|DWELL 2                                                                    VENT VALVE                 |
|VENT VALVE                                                                 2 TIMER                    |
|CV2                                                                        OPCHV2T                    |
|   O:007                                                                   +--TON-----------------+   |
|---| |---------------------------------------------------------------------|TIMER ON DELAY        |-(EN)-|
|    17                                                                     |TIMER:        T4:145  |   |
|[2:396]                                                                    |BASE (SEC):      1.0  |-(DN)|
|                                                                           |PRESET:            5  |   |
|                                                                           |ACCUM:             0  |   |
|                                                                           +----------------------+   |
T4:145.DN - -| |- - File #5 FAULTS -  145
Rung #145
|FAULT                                                                                                 |
|DETECT       DWELL 1                                                                    CHAMBER       |
|CHAMBER      CHAMBER                                                                    VENT VALVE    |
|VENT VALVE   VENT VALVE                                                                 2 OPEN        |
|2 OPEN       OPEN                                                                       FAULT         |
|OPCHV2T      CVS4                                                                       CHV2OPF       |
|  T4:145       I:002                                                                       B3         |
|---| |----------|/|-----------------------------------------------------------------------( )---------|
|    DN           14                                                                        165        |
|[144]                                                                                                 |
B3/165 - -|/|- - File #5 FAULTS -  156
         -( )- - File #5 FAULTS -  145
```

Rung #146

```
|                                                   CLOSE
|OPEN                                               CHAMBER
|DWELL 2                                            VENT VALVE
|VENT VALVE                                         2 TIMER
|CV2                                                CLCHV2T
|  O:007                                            +-TON-----------------+
|---|/|---------------------------------------------+TIMER ON DELAY       +-(EN)-
|    17                                             |TIMER:        T4:146 |
|[2:396]                                            |BASE (SEC):      1.0 +-(DN)
|                                                   |PRESET:            5 |
|                                                   |ACCUM:             5 |
|                                                   +---------------------+
T4:146.DN - -| |- - File #5 FAULTS -  147
```

Rung #147

```
|FAULT
|DETECT      DWELL 1                                CHAMBER
|CHAMBER     CHAMBER                                VENT VALVE
|VENT VALVE  VENT VALVE                             2 CLOSE
|2 CLOSE     CLOSED                                 FAULT
|CLCHV2T     CVS3                                   CHV2CLF
|  T4:146       I:002                                    B3
|---| |---------|/|-----------------------------------( )---
|    DN          13                                     166
|[146]
B3/166 - -|/|- - File #5 FAULTS -  156
         -( )- - File #5 FAULTS -  147
```

ng #148

```
|                                                   OPEN
|OPEN                                               CHAMBER
|DWELL 3                                            VENT VALVE
|VENT VALVE                                         3 TIMER
|CV3                                                OPCHV3T
|  O:027                                            +-TON-----------------+
|---| |---------------------------------------------+TIMER ON DELAY       +-(EN)-
|    16                                             |TIMER:        T4:147 |
|[2:401]                                            |BASE (SEC):      1.0 +-(DN)
|                                                   |PRESET:            5 |
|                                                   |ACCUM:             0 |
|                                                   +---------------------+
T4:147.DN - -| |- - File #5 FAULTS -  149
```

Rung #149

```
|FAULT
|DETECT      DWELL 3                                CHAMBER
|CHAMBER     CHAMBER                                VENT VALVE
|VENT VALVE  VENT VALVE                             3 OPEN
|3 OPEN      OPEN                                   FAULT
|OPCHV3T     CVS6                                   CHV3OPF
   T4:147       I:022                                    B3
|---| |---------|/|-----------------------------------( )---
|    DN          12                                     167
|[148]
B3/167 - -|/|- - File #5 FAULTS -  156
         -( )- - File #5 FAULTS -  149
```

```
Rung #150                                                               CLOSE
|                                                                       CHAMBER
|OPEN                                                                   VENT VALVE
|DWELL 3                                                                3 TIMER
|VENT VALVE                                                             CLCHV3T
|CV3                                                                    +-TON-----------------+
|  O:027                                                              +-|TIMER ON DELAY       |-(EN)-
|---|/|---------------------------------------------------------------+ |TIMER:       T4:148|
|    16                                                                 |BASE (SEC):     1.0|-(DN)
|[2:401]                                                                |PRESET:           5|
|                                                                       |ACCUM:            5|
|                                                                       +---------------------+
T4:148.DN - -] [- - File #5 FAULTS -  151
Rung #151
|FAULT                                                                  CHAMBER
|DETECT       DWELL 4                                                   VENT VALVE
|CHAMBER      CHAMBER                                                   3 CLOSE
|VENT VALVE   VENT VALVE                                                FAULT
|3 CLOSE      CLOSED                                                    CHV3CLF
|CLCHV3T      CVS5                                                      B3
|  T4:148     I:022
|---] [--------|/|-------------------------------------------------------( )---
|     DN       11                                                       168
|[150]
B3/168 - -]/[- - File #5 FAULTS -  156
         -( )- - File #5 FAULTS -  151
  ng #152                                                               OPEN
|                                                                       CHAMBER
|OPEN                                                                   VENT VALVE
|DWELL 5                                                                4 TIMER
|VENT VALVE                                                             OPCHV4T
|CV4                                                                    +-TON-----------------+
|  O:043                                                              +-|TIMER ON DELAY       |-(EN)-
|---] [---------------------------------------------------------------+ |TIMER:       T4:149|
|    16                                                                 |BASE (SEC):     1.0|-(DN)
|[2:403]                                                                |PRESET:           5|
|                                                                       |ACCUM:            0|
|                                                                       +---------------------+
T4:149.DN - -] [- - File #5 FAULTS -  153
Rung #153
|FAULT                                                                  CHAMBER
|DETECT       DWELL 5                                                   VENT VALVE
|CHAMBER      CHAMBER                                                   4 OPEN
|VENT VALVE   VENT VALVE                                                FAULT
|4 OPEN       OPEN                                                      CHV4OPF
|OPCHV4T      CVS8                                                      B3
   T4:149     I:036
 ---] [--------|/|-------------------------------------------------------( )---
|     DN       12                                                       169
|[152]
B3/169 - -]/[- - File #5 FAULTS -  156
         -( )- - File #5 FAULTS -  153
```

```
Rung #154
|                                                                                  CLOSE                 |
|OPEN                                                                              CHAMBER               |
|DWELL 5                                                                           VENT VALVE            |
|VENT VALVE                                                                        4 TIMER               |
|CV4                                                                               CLCHV4T               |
|  0:043                                                                           +--TON-------------+  |
|--|/|-----------------------------------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   16                                                                             |TIMER:     T4:150 |      |
|[2:403]                                                                           |BASE (SEC):  1.0  |-(DN) |
|                                                                                  |PRESET:        5  |      |
|                                                                                  |ACCUM:         5  |      |
|                                                                                  +------------------+      |
T4:150.DN - -| |- - File #5 FAULTS - 155
Rung #155
|FAULT                                                                                                   |
|DETECT      DWELL 5                                                                      CHAMBER        |
|CHAMBER     CHAMBER                                                                      VENT VALVE     |
|VENT VALVE  VENT VALVE                                                                   4 CLOSE        |
|4 CLOSE     CLOSED                                                                       FAULT          |
|CLCHV4T     CVS7                                                                         CHV4CLF        |
|  T4:150     I:036                                                                           B3         |
|---| |--------|/|----------------------------------------------------------------------------( )--------|
|    DN         11                                                                            170        |
|[154]                                                                                                   |
B3/170 - -|/|- - File #5 FAULTS - 156
         -( )- - File #5 FAULTS - 155
 .ng #156
|CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER                                          |
|VENT VALVE VENT VALVE VENT VALVE VENT VALVE VENT VALVE VENT VALVE                        CHAMBER        |
|2 OPEN     2 CLOSE    3 OPEN     3 CLOSE    4 OPEN     4 CLOSE                           VENT VALVE     |
|FAULT      FAULT      FAULT      FAULT      FAULT      FAULT                             NO FAULT       |
|CHV2OPF    CHV2CLF    CHV3OPF    CHV3CLF    CHV4OPF    CHV4CLF                           CHVNF          |
|   B3         B3         B3         B3         B3         B3                                 B3         |
|---|/|-------|/|--------|/|--------|/|--------|/|--------|/|---------------------------------( )--------|
|   165        166        167        168        169        170                              173        |
|[145]      [147]      [149]      [151]      [153]      [155]                                            |
B3/173 - -|/|- - File #5 FAULTS - 157
         -( )- - File #5 FAULTS - 156
Rung #157
|CHAMBER                                                                                  CHAMBER        |
|VENT VALVE                                                                               VENT VALVE     |
|NO FAULT                                                                                 FAULT          |
|CHVNF                                                                                    CHVF           |
|   B3                                                                                        B3         |
|---|/|---------------------------------------------------------------------------------------(L)--------|
|   173                                                                                       174        |
|[156]                                                                                                   |
"3/174 - -| |- - File #2 MAIN_PRGRM - 625
         -(L)- - File #5 FAULTS - 157
         -(U)- - File #5 FAULTS - 158
Rung #158
|                                                                                         CHAMBER        |
|PAUSE                                                                                    VENT VALVE     |
|DISABLE                                                                                  FAULT          |
|TS12                                                                                     CHVF           |
|  N7:16                                                                                      B3         |
|---| |---------------------------------------------------------------------------------------(U)--------|
|    4                                                                                        174        |
|[2:3]                                                                                                   |
B3/174 - -| |- - File #2 MAIN_PRGRM - 625
         -(L)- - File #5 FAULTS - 157
```

```
        -(U)- - File #5 FAULTS -  158
Rung #159
|OPEN                                                        OPEN              |
|LOAD LOCK                                                   ROUGH VENT        |
|ROUGH                                                       VALVE 1           |
|VALVE                                                       TIMER             |
|RV1                                                         OPRV1T            |
|                                                           +-TON------------+ |
|  O:010                                                    |                | |
|---] [------------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|   11                                                      |TIMER:   T4:153 | |
|[2:167]                                                    |BASE (SEC):  1.0+-(DN) |
|                                                           |PRESET:      23 | |
|                                                           |ACCUM:        0 | |
|                                                           +----------------+ |
T4:153.DN - -] [- - File #5 FAULTS -  160
Rung #160
|FAULT        LLOCK                                                            |
|DETECT       CHAMBER                                                          |
|ROUGH VENT   ROUGH                                             ROUGH VALVE 1  |
|VALVE 1      VALVE                                             OPEN FAULT     |
|OPEN         OPEN                                              RV1OPF         |
|OPRV1T       RVS2                                                      B3     |
|  T4:153     I:002                                                            |
|---] [--------]/[-----------------------------------------------------( )-----|
|   DN         16                                                      126     |
|[159]
B3/126 - -]/[- - File #5 FAULTS -  179
       -( )- - File #5 FAULTS -  160
Rung #161
|OPEN                                                        CLOSE             |
|LOAD LOCK                                                   ROUGH VENT        |
|ROUGH                                                       VALVE 1           |
|VALVE                                                       TIMER             |
|RV1                                                         CLRV1T            |
|                                                           +-TON------------+ |
|  O:010                                                    |                | |
|---]/[------------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|   11                                                      |TIMER:   T4:154 | |
|[2:167]                                                    |BASE (SEC):  1.0+-(DN) |
|                                                           |PRESET:       5 | |
|                                                           |ACCUM:        4 | |
|                                                           +----------------+ |
T4:154.DN - -] [- - File #5 FAULTS -  162
Rung #162
|FAULT        LLOCK                                                  ROUGH     |
|DETECT       CHAMBER                                                VALVE 1   |
|ROUGH VENT   ROUGH                                                  CLOSE     |
|VALVE 1      VALVE                                                  FAULT     |
|CLOSE        CLOSED                                                 RV1CLF    |
|CLRV1T       RVS1                                                      B3     |
|  T4:154     I:002                                                            |
|---] [--------]/[-----------------------------------------------------( )-----|
|   DN         15                                                      127     |
|[161]
B3/127 - -]/[- - File #5 FAULTS -  179
       -( )- - File #5 FAULTS -  162
```

```
Rung #163
|OPEN                                                              OPEN           |
|DWELL 2                                                           ROUGH VENT     |
|ROUGH                                                             VALVE 2        |
|VALVE                                                             TIMER          |
|RV2                                                               OPRV2T         |
| 0:030                                                           +--TON--------+ |
|--] [------------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   11                                                            |TIMER:  T4:155|       |
|[2:56]                                                           |BASE (SEC): 1.0|-(DN) |
|                                                                 |PRESET:      5|       |
|                                                                 |ACCUM:       0|       |
|                                                                 +--------------+       |
T4:155.DN - ] [ - File #5 FAULTS - 164
Rung #164
|FAULT       DWELL 2                                                               |
|DETECT      CHAMBER                                                               |
|ROUGH VENT  ROUGH                                                                 |
|VALVE 2     VALVE                                                 ROUGH VALVE 2   |
|OPEN        OPEN                                                  OPEN FAULT      |
|OPRV2T      RVS4                                                  RV2OPF          |
|  T4:155     I:022                                                      B3        |
|---] [--------]/[------------------------------------------------------( )-------|
|    DN         16                                                      128        |
|[163]                                                                              |
B3/128 - ]/[ - File #5 FAULTS - 179
       -( )- - File #5 FAULTS - 164
  ng #165
|OPEN                                                              CLOSE          |
|DWELL 2                                                           ROUGH VENT     |
|ROUGH                                                             VALVE 2        |
|VALVE                                                             TIMER          |
|RV2                                                               CLRV2T         |
| 0:030                                                           +--TON--------+ |
|--]/[------------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   11                                                            |TIMER:  T4:156|       |
|[2:56]                                                           |BASE (SEC): 1.0|-(DN) |
|                                                                 |PRESET:      5|       |
|                                                                 |ACCUM:       5|       |
|                                                                 +--------------+       |
T4:156.DN - ] [ - File #5 FAULTS - 166
Rung #166
|FAULT       DWELL 2                                                               |
|DETECT      CHAMBER                                                               |
|ROUGH VENT  ROUGH                                                                 |
|VALVE 2     VALVE RV2                                             ROUGH VALVE 2   |
|CLOSE       CLOSED                                                CLOSE FAULT     |
|CLRV2T      RVS3                                                  RV2CLF          |
'  T4:156     I:022                                                      B3        |
   ---] [--------]/[------------------------------------------------------( )-------|
|    DN         15                                                      129        |
|[165]                                                                              |
B3/129 - ]/[ - File #5 FAULTS - 179
       -( )- - File #5 FAULTS - 166
```

```
Rung #167                                                              OPEN
|OPEN                                                                  ROUGH VENT
|DWELL 4                                                               VALVE 3
|ROUGH                                                                 TIMER
|VALVE                                                                 OPRV3T
|RV3                                                                   +--TON---------------+
| O:044                                                                |TIMER ON DELAY      |-(EN)-
|--] [-----------------------------------------------------------------|TIMER:      T4:157 |
|   11                                                                 |BASE (SEC):    1.0  |-(DN)
|[2:57]                                                                |PRESET:          5  |
|                                                                      |ACCUM:           0  |
|                                                                      +--------------------+
T4:157.DN - ] [ - File #5 FAULTS - 168
Rung #168
|FAULT        DWELL 4
|DETECT       CHAMBER
|ROUGH VENT   ROUGH                                                         ROUGH VALVE 3
|VALVE 3      VALVE                                                         OPEN FAULT
|OPEN         OPEN                                                          RV3OPF
|OPRV3T       RVS6                                                              B3
|  T4:157      I:036
|---] [--------]/[--------------------------------------------------------------( )---
|     DN        16                                                             130
|[167]
B3/130 - ]/[ - File #5 FAULTS - 179
        -( )- - File #5 FAULTS - 168
Rung #169                                                              CLOSE
|OPEN                                                                  ROUGH VENT
|DWELL 4                                                               VALVE 1
|ROUGH                                                                 TIMER
|VALVE                                                                 CLRV3T
|RV3                                                                   +--TON---------------+
| O:044                                                                |TIMER ON DELAY      |-(EN)-
|--]/[-----------------------------------------------------------------|TIMER:      T4:158 |
|   11                                                                 |BASE (SEC):    1.0  |-(DN)
|[2:57]                                                                |PRESET:          5  |
|                                                                      |ACCUM:           5  |
|                                                                      +--------------------+
T4:158.DN - ] [ - File #5 FAULTS - 170
Rung #170
|FAULT        DWELL 4
|DETECT       CHAMBER
|ROUGH VENT   ROUGH                                                         ROUGH VALVE 3
|VALVE 3      VALVE                                                         CLOSE FAULT
|CLOSE        CLOSED                                                        RV3CLF
|CLRV3T       RVS5                                                              B3
|  T4:158      I:036
|---] [--------]/[--------------------------------------------------------------( )---
|     DN        15                                                             131
|[169]
B3/131 - ]/[ - File #5 FAULTS - 179
        -( )- - File #5 FAULTS - 170
```

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```
Rung #171
|OPEN                                                              OPEN               |
|DWELL 6                                                           ROUGH VENT         |
|ROUGH                                                             VALVE 4            |
|VALVE                                                             TIMER              |
|RV4                                                               OPRV4T             |
| O:060                                                           +-TON-------------+ |
|--| |------------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|   11                                                            |TIMER:    T4:159| |
|[2:58]                                                           |BASE (SEC):  1.0|-(DN) |
|                                                                 |PRESET:        5| |
|                                                                 |ACCUM:         0| |
|                                                                 +-----------------+ |
T4:159.DN - -| |- - File #5 FAULTS - 172
Rung #172
|          DWELL 5                                                                    |
|FAULT     CHAMBER                                                                    |
|DETECT    ROUGH                                                                      |
|ROUGH VENT VALVE                                                      ROUGH VALVE 4  |
|VALVE 4   OPEN                                                        OPEN FAULT     |
|OPRV4T    RVS8                                                        RV4OPF         |
| T4:159   I:052                                                            B3        |
|--| |-------|/|---------------------------------------------------------( )---------|
|   DN       15                                                             132       |
|[171]                                                                                |
B3/132 - -|/|- - File #5 FAULTS - 179
         -( )- - File #5 FAULTS - 172
ung #173
|OPEN                                                              CLOSE              |
|DWELL 6                                                           ROUGH VENT         |
|ROUGH                                                             VALVE 4            |
|VALVE                                                             TIMER              |
|RV4                                                               CLRV4T             |
| O:060                                                           +-TON-------------+ |
|--|/|------------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|   11                                                            |TIMER:    T4:160| |
|[2:58]                                                           |BASE (SEC):  1.0|-(DN) |
|                                                                 |PRESET:        5| |
|                                                                 |ACCUM:         5| |
|                                                                 +-----------------+ |
T4:160.DN - -| |- - File #5 FAULTS - 174
Rung #174
|FAULT     DWELL 5                                                                    |
|DETECT    CHAMBER                                                                    |
|ROUGH VENT ROUGH                                                                     |
|VALVE 4   VALVE                                                       ROUGH VALVE 4  |
|CLOSE     CLOSED                                                      CLOSE FAULT    |
|CLRV4T    RVS7                                                        RV4CLF         |
| T4:160   I:052                                                            B3        |
 --| |-------|/|---------------------------------------------------------( )---------|
|   DN       14                                                             133       |
|[173]                                                                                |
B3/133 - -|/|- - File #5 FAULTS - 179
         -( )- - File #5 FAULTS - 174
```

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```
Rung #175
|OPEN                                                                   OPEN
|EXLOCK                                                                 ROUGH VENT
|ROUGH                                                                  VALVE 5
|VALVE                                                                  TIMER
|RV5                                                                    OPRV5T
| O:060                                                                 +-TON-----------------+
|-| |-------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
|  12                                                                   |TIMER:       T4:161|       |
|[2:340]                                                                |BASE (SEC):     1.0+-(DN)  |
|                                                                       |PRESET:          60|       |
|                                                                       |ACCUM:            0|       |
|                                                                       +-------------------+       |
T4:161.DN - -| |- - File #5 FAULTS - 176
Rung #176
|FAULT        EXLOCK                                                                               |
|DETECT       CHAMBER                                                                              |
|ROUGH VENT   ROUGH                                                                                |
|VALVE 5      VALVE                                                        ROUGH VALVE 5           |
|OPEN         OPEN                                                         OPEN FAULT              |
|OPRV5T       RVS10                                                        RV5OPF                  |
|   T4:161    I:052                                                             B3                 |
|-----| |-------|/|--------------------------------------------------------------( )---------------|
|     DN        17                                                              134                |
|[175]
B3/134 - -|/|- - File #5 FAULTS - 179
         -( )- - File #5 FAULTS - 176
ng #177
|OPEN                                                                   CLOSE                      |
|EXLOCK                                                                 ROUGH VENT                 |
|ROUGH                                                                  VALVE 5                    |
|VALVE                                                                  TIMER                      |
|RV5                                                                    CLRV5T                     |
| O:060                                                                 +-TON-----------------+    |
|-|/|-------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
|  12                                                                   |TIMER:       T4:162|      |
|[2:340]                                                                |BASE (SEC):     1.0+-(DN) |
|                                                                       |PRESET:           5|      |
|                                                                       |ACCUM:            5|      |
|                                                                       +-------------------+      |
T4:162.DN - -| |- - File #5 FAULTS - 178
Rung #178
|FAULT        EXLOCK                                                                               |
|DETECT       CHAMBER                                                                              |
|ROUGH VENT   ROUGH                                                                                |
|VALVE 5      VALVE                                                        ROUGH VALVE 5           |
|CLOSE        CLOSED                                                       CLOSE FAULT             |
|CLRV5T       RVS9                                                         RV5CLF                  |
|   T4:162    I:052                                                             B3                 |
|  -| |---------|/|--------------------------------------------------------------( )---------------|
|     DN        16                                                              135                |
|[177]
B3/135 - -|/|- - File #5 FAULTS - 179
         -( )- - File #5 FAULTS - 178
Rung #179
|             ROUGH
|             VALVE 1
|ROUGH VALVE 1 CLOSE   ROUGH VALVE 2 ROUGH VALVE 2 ROUGH VALVE 3 ROUGH VALVE 3 ROUGH VALVE 4 ROUGH VALVE 4 ROUGH VALVE 5
|OPEN FAULT    FAULT   OPEN FAULT    CLOSE FAULT   OPEN FAULT    CLOSE FAULT   OPEN FAULT    CLOSE FAULT   OPEN FAULT
|RV1OPF        RV1CLF  RV2OPF        RV2CLF        RV3OPF        RV3CLF        RV4OPF        RV4CLF        RV5OPF
|    B3         B3      B3            B3            B3            B3            B3            B3            B3
|----|/|--------|/|-----|/|-----------|/|-----------|/|-----------|/|-----------|/|-----------|/|-----------|/|----
|    126        127     128           129           130           131           132           133           134
>
```

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```
<
|[160]      [162]   [164]      [166]      [168]      [170]      [172]      [174]      [176]
                                                                                      ROUGH VENT |
                                                                         ROUGH VALVE 5 VALVE      |
                                                                         CLOSE FAULT   NO FAULT   |
                                                                         RV5CLF        RVVNF      |
                                                                             B3            B3     |
                                                                         ----|/|----------( )-----|
                                                                             135           384    |
                                                                         [178]                    |
B3/384 - -|/|- - File #5 FAULTS -  180
         -( )- - File #5 FAULTS -  179
```

Rung #180

```
|ROUGH VENT                                                                   ROUGH VENT |
|VALVE                                                                        VALVE      |
|NO FAULT                                                                     FAULT      |
|RVVNF                                                                        RVVF       |
|    B3                                                                           B3     |
|---|/|---------------------------------------------------------------------------(L)-----|
|   384                                                                           386    |
|[179]                                                                                   |
B3/386 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  180
         -(U)- - File #5 FAULTS -  181
```

Rung #181

```
|                                                                             ROUGH VENT |
|PAUSE                                                                        VALVE      |
  SABLE                                                                       FAULT      |
|TS12                                                                         RVVF       |
|  N7:16                                                                          B3     |
|---| |---------------------------------------------------------------------------(U)-----|
|    4                                                                            386    |
|[2:3]                                                                                   |
B3/386 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  180
         -(U)- - File #5 FAULTS -  181
```

Rung #182

```
|MECHANICAL             ROUGHING                                 ROUGHING              |
|PUMP 1      BLOWER 1   SECTION 1                                SECTION 1             |
|ENABLED     ENABLED    PRESSURE                                 TIMER                 |
|MP1         BL1        PS1                                      RS1T                  |
|  0:007       0:007      I:002                                  +--TON-------------+  |
|---| |--------| |--------| |------------------------------------|TIMER ON DELAY    |-(EN)-|
|    00          01         03                                   |TIMER:       T4:7 |      |
|[2:68]      [2:69]                                              |BASE (SEC):   1.0 |-(DN) |
|                                                                |PRESET:        60 |      |
|                                                                |ACCUM:          0 |      |
|                                                                +------------------+      |
T4:7.DN - -| |- - File #5 FAULTS -  183
```

ung #183

```
|FAULT                                                                                   |
|DETECT                                                                       ROUGHING   |
|ROUGHING                                                                     SECTION 1  |
|SECTION 1                                                                    FAULT      |
|RS1T                                                                         RS1F       |
|  T4:7                                                                           B3     |
|---| |---------------------------------------------------------------------------( )-----|
|    DN                                                                           438    |
|[182]                                                                                   |
B3/438 - -| |- - File #5 FAULTS -  188
         -( )- - File #5 FAULTS -  183
```

644

```
Rung #184
|MECHANICAL              ROUGHING                                        ROUGHING            |
|PUMP 2      BLOWER 2    SECTION 2                                       SECTION 2           |
|ENABLED     ENABLED     PRESSURE                                        TIMER               |
|MP2         BL2         PS8                                             RS2T                |
|  0:027       0:027       I:022                                         +-TON-------------+ |
|---] [--------] [---------] [-------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    00          01          05                                          |TIMER:       T4:8| |
|[2:73]      [2:74]                                                      |BASE (SEC):   1.0|-(DN) |
|                                                                        |PRESET:        60| |
|                                                                        |ACCUM:          0| |
|                                                                        +-----------------+ |
T4:8.DN - ] [ - File #5 FAULTS -  185
Rung #185
|FAULT                                                                                       |
|DETECT                                                                          ROUGHING    |
|ROUGHING                                                                        SECTION 2   |
|SECTION 2                                                                       FAULT       |
|RS2T                                                                            RS2F        |
|  T4:8                                                                            B3        |
|---] [------------------------------------------------------------------------------( )-----|
|    DN                                                                            439       |
|[184]                                                                                       |
B3/439 - ] [ - File #5 FAULTS -  188
       -( )- - File #5 FAULTS -  185
Rung #186
|MECHANICAL              ROUGHING                                        ROUGHING            |
  MP 3       BLOWER 3    SECTION 3                                       SECTION 3           |
|ENABLED     ENABLED     PRESSURE                                        TIMER               |
|MP3         BL3         PS7                                             RS3T                |
|  0:057       0:057       I:052                                         +-TON-------------+ |
|---] [--------] [---------] [-------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    00          01          05                                          |TIMER:       T4:9| |
|[2:78]      [2:79]                                                      |BASE (SEC):   1.0|-(DN) |
|                                                                        |PRESET:        60| |
|                                                                        |ACCUM:          0| |
|                                                                        +-----------------+ |
T4:9.DN - ] [ - File #5 FAULTS -  187
Rung #187
|FAULT                                                                                       |
|DETECT                                                                          ROUGHING    |
|ROUGHING                                                                        SECTION 3   |
|SECTION 3                                                                       FAULT       |
|RS3T                                                                            RS3F        |
|  T4:9                                                                            B3        |
|---] [------------------------------------------------------------------------------( )-----|
|    DN                                                                            440       |
|[186]                                                                                       |
B3/440 - ] [ - File #5 FAULTS -  188
       -( )- - File #5 FAULTS -  187
```

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Rung #188

```
| ROUGHING                                                    |
| SECTION 1                                        MECHANICAL |
| FAULT                                          PUMP FAILURE |
| RS1F                                            MECH_P_FAIL |
|     B3                                                   B3 |
|-+---] [---+----------------------------------------------(L)-|
| |   438   |                                             385 |
| | [183]   |                                                 |
| |         | B3/385 - ] [ - File #2 MAIN_PRGRM - 626         |
| |         |         -(U)- - File #5 FAULTS - 189            |
| |ROUGHING |                                                 |
| |SECTION 2|                                                 |
| |FAULT    |                                                 |
| |RS2F     |                                                 |
| |   B3    |                                                 |
| |---] [---|                                                 |
| |   439   |                                                 |
| |[185]    |                                                 |
| |ROUGHING |                                                 |
| |SECTION 3|                                                 |
| |FAULT    |                                                 |
| |RS3F     |                                                 |
| |   B3    |                                                 |
| +---] [---+                                                 |
|     440                                                     |
  [187]
```

.ng #189

```
|PAUSE                                             MECHANICAL |
|DISABLE                                         PUMP FAILURE |
|TS12                                             MECH_P_FAIL |
| N7:16                                                    B3 |
|---] [----------------------------------------------------(U)-|
|    4                                                    385 |
|[2:3]                                                        |
B3/385 - ] [ - File #2 MAIN_PRGRM - 626
        -(L)- - File #5 FAULTS - 188
        -(U)- - File #5 FAULTS - 189
```

Rung #190

```
|                                                      HEATER |
| HEATER                                          SHIELD H20 |
| SHIELD H20                                            FLOW |
| FLOW                                               GROUP 1 |
| SWITCH 1                                             FAULT |
| HSFS1                                              HSFG1F |
|    I:006                                                 B3 |
|-+---]/[---+-----------------------------------------------( )-|
| |   10    |                                             216 |
| |HEATER   | B3/216 - ] [ - File #5 FAULTS - 199             |
| |SHIELD H20|        ]/[ - File #2 MAIN_PRGRM - 213          |
| |FLOW     |                                                 |
| |SWITCH 2 |                                                 |
| |HSFS2    |                                                 |
| |  I:006  |                                                 |
| +---]/[---+                                                 |
|     11                                                      |
```

```
Rung #191
|                                                                          HEATER       |
| HEATER                                                                   SHIELD H2O   |
| SHIELD H2O                                                               FLOW         |
| FLOW                                                                     GROUP 2      |
| SWITCH 3                                                                 FAULT        |
| HSFS3                                                                    HSFG2F       |
|     I:006                                                                    B3       |
|-+----]/[---+-------------------------------------------------------------( )---------|
| |     12   |                                                               217        |
| |HEATER    | B3/217 - ] [ - - File #5 FAULTS - 199                                    |
| |SHIELD H2O|          ]/[ - - File #2 MAIN_PRGRM - 226                                |
| |FLOW      |                                                                          |
| |SWITCH 4  |                                                                          |
| |HSFS4     |                                                                          |
| |   I:006  |                                                                          |
| +----]/[---+                                                                          |
|       13                                                                              |
Rung #192
|                                                                          HEATER       |
| HEATER                                                                   SHIELD H2O   |
| SHIELD H2O                                                               FLOW         |
| FLOW                                                                     GROUP 3      |
| SWITCH 5                                                                 FAULT        |
| HSFS5                                                                    HSFG3F       |
|     I:023                                                                    B3       |
|-+----]/[---+-[AFI]-------------------------------------------------------( )---------|
| |     16   |                                                               218        |
| |HEATER    | B3/218 - ] [ - - File #5 FAULTS - 199                                    |
| |SHIELD H2O|                                                                          |
| |FLOW      |                                                                          |
| |SWITCH 6  |                                                                          |
| |HSFS6     |                                                                          |
| |   I:023  |                                                                          |
| +----]/[---+                                                                          |
|       17                                                                              |
```

647

Rung #193

```
|                                                                          CATHODE  |
|                                                                          H2O FLOW |
| CATHODE                                                                  SWITCH   |
| WATER FLOW                                                               GROUP 1  |
| SWITCH 1                                                                 FAULT    |
| CHR1A                                                                    CWFSG1F  |
|    I:026                                                                   B3     |
|-+---]/[---+------------------------------------------------------------( )-------|
| |   10    |                                                               136    |
| |         | B3/136 - ] [ - File #5 FAULTS - 202                                  |
| |CATHODE  |                                                                      |
| |WATER FLOW|                                                                     |
| |SWITCH 2 |                                                                      |
| |CHR2A    |                                                                      |
| |  I:026  |                                                                      |
| |---]/[---|                                                                      |
| |   11    |                                                                      |
| |CATHODE  |                                                                      |
| |WATER FLOW|                                                                     |
| |SWITCH 3 |                                                                      |
| |CHR3A    |                                                                      |
| |  I:026  |                                                                      |
| |---]/[---|                                                                      |
| |   12    |                                                                      |
| |CATHODE  |                                                                      |
| |WATER FLOW|                                                                     |
|  SWITCH 4 |                                                                      |
| |CHR4A    |                                                                      |
| |  I:026  |                                                                      |
| |---]/[---|                                                                      |
| |   13    |                                                                      |
| |CATHODE  |                                                                      |
| |SHIELD H2O|                                                                     |
| |FLOW     |                                                                      |
| |SWITCH 1 |                                                                      |
| |CSFS1    |                                                                      |
| |  I:025  |                                                                      |
| |---]/[---|                                                                      |
| |   04    |                                                                      |
| |CATHODE  |                                                                      |
| |SHIELD H2O|                                                                     |
| |FLOW     |                                                                      |
| |SWITCH 2 |                                                                      |
| |CSFS2    |                                                                      |
| |  I:025  |                                                                      |
| +---]/[---+                                                                      |
|     05                                                                           |
```

```
Rung #194
|                                                                     CATHODE  |
|                                                                     H2O FLOW |
|                                                                     SWITCH   |
| WATER FLOW                                                          GROUP 2  |
| SWITCH 5                                                            FAULT    |
| CHR1B                                                               CWFSG2F  |
|    I:026                                                               B3    |
|-+---]/[---+--------------------------------------------------------( )------|
| |   14    |                                                            137   |
| |         | B3/137 - -] [- - File #5 FAULTS - 202                            |
| |CATHODE  |                                                                  |
| |WATER FLOW                                                                  |
| |SWITCH 6 |                                                                  |
| |CHR2B    |                                                                  |
| |  I:026  |                                                                  |
| +---]/[---+                                                                  |
| |   15    |                                                                  |
| |CATHODE  |                                                                  |
| |WATER FLOW                                                                  |
| |SWITCH 7 |                                                                  |
| |CHR3B    |                                                                  |
| |  I:026  |                                                                  |
| +---]/[---+                                                                  |
| |   16    |                                                                  |
| |CATHODE  |                                                                  |
| |WATER FLOW                                                                  |
| |SWITCH 8 |                                                                  |
| |CHR4B    |                                                                  |
| |  I:026  |                                                                  |
| +---]/[---+                                                                  |
|     17                                                                       |
```

Rung #195

```
                                                                CATHODE
  CATHODE                                                       H2O FLOW
  WATER FLOW                                                    SWITCH
  SWITCH 9                                                      GROUP 3
  WFS9                                                          FAULT
     I:042                                                      CWFSG3F
                                                                  B3
 ----]/[----+--------------------------------------------------( )--
     10     |                                                    138
            | B3/138 - ] [ - File #5 FAULTS - 202
 CATHODE    |
 WATER FLOW |
 SWITCH 10  |
 WFS10      |
    I:042   |
 ---]/[-----+
    11      |
 CATHODE    |
 WATER FLOW |
 SWITCH 11  |
 WFS11      |
    I:042   |
 ---]/[-----+
    12      |
 CATHODE    |
 WATER FLOW |
 SWITCH 12  |
 WFS12      |
    I:042   |
 ---]/[-----+
    13      |
 CATHODE    |
 SHIELD H2O |
 FLOW       |
 SWITCH 9   |
 CSFS9      |
    I:041   |
 ---]/[-----+
    04      |
 CATHODE    |
 SHIELD H2O |
 FLOW       |
 SWITCH 10  |
 CSFS10     |
    I:041   |
 ---]/[-----+
    05
```

Rung #196

```
|                                                                         CATHODE    |
|                                                                         H2O FLOW   |
| CATHODE                                                                 SWITCH     |
| WATER FLOW                                                              GROUP 4    |
| SWITCH 13                                                               FAULT      |
| WFS13                                                                   CWFSG4F    |
|    I:042                                                                   B3      |
|-+---]/[--+--------------------------------------------------------------( )-------|
| |   14   |                                                                139     |
| |        | B3/139 - -] [- - File #5 FAULTS - 202                                  |
| |CATHODE |                                                                        |
| |WATER FLOW                                                                       |
| |SWITCH 14                                                                        |
| |WFS14   |                                                                        |
| |  I:042 |                                                                        |
| |---]/[--|                                                                        |
| |   15   |                                                                        |
| |CATHODE |                                                                        |
| |WATER FLOW                                                                       |
| |SWITCH 15                                                                        |
| |WFS15   |                                                                        |
| |  I:042 |                                                                        |
| |---]/[--|                                                                        |
| |   16   |                                                                        |
| |CATHODE |                                                                        |
| |WATER FLOW                                                                       |
|   ITCH 16                                                                         |
| |WFS16   |                                                                        |
| |  I:042 |                                                                        |
| +---]/[--+                                                                        |
|     17                                                                            |
```

651

Rung #197

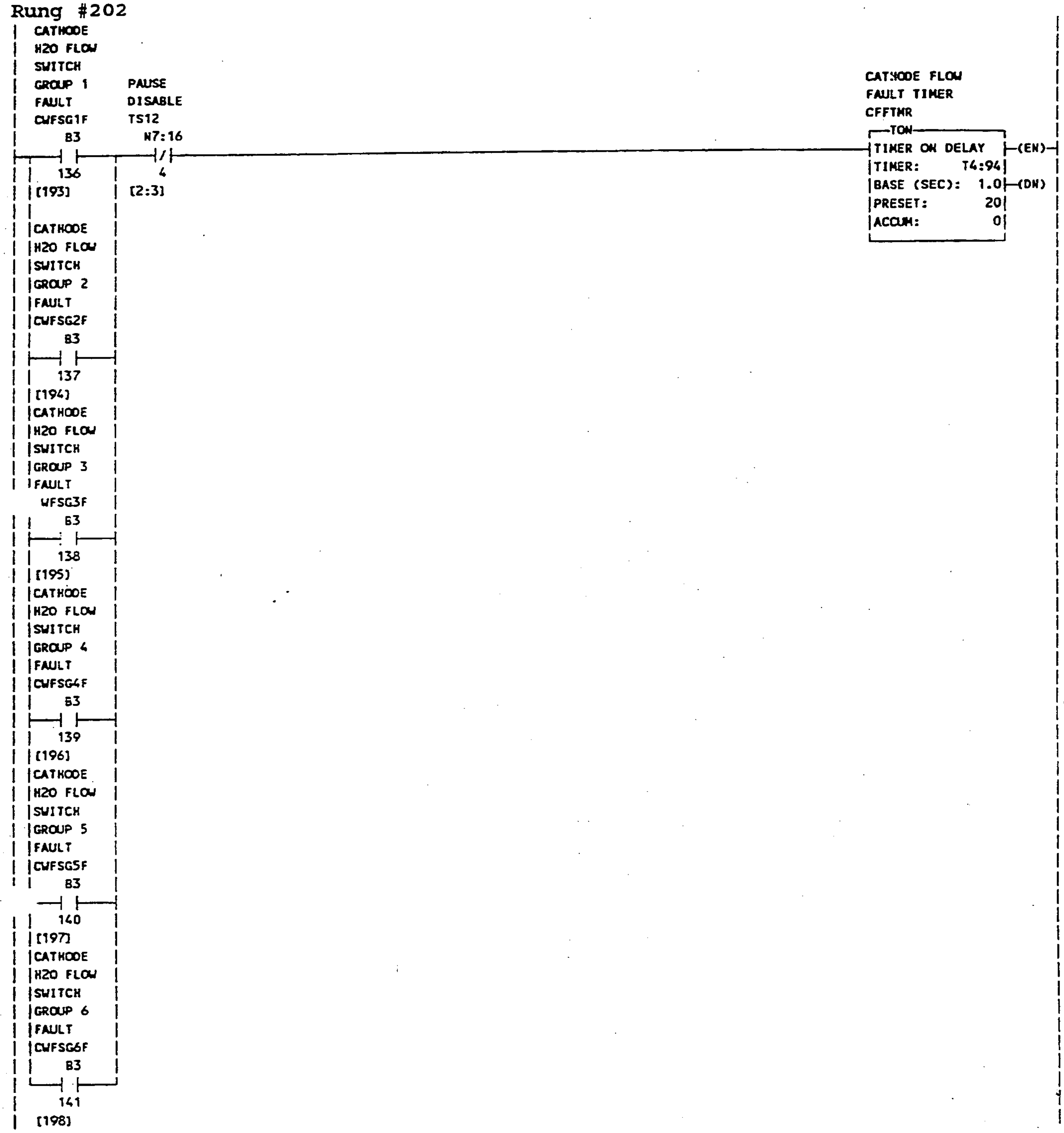
```
|                                                                                   CATHODE   |
|                                                                                   H2O FLOW  |
| CATHODE                                                                           SWITCH    |
| WATER FLOW                                                                        GROUP 5   |
| SWITCH 17                                                                         FAULT     |
| WFS17                                                                             CWFSG5F   |
|    I:056                                                                            B3      |
|-+---|/|---+-----------------------------------------------------------------------( )-----|
| |   10    |                                                                       140     |
| |         | B3/140 - -| |- - File #5 FAULTS - 202                                          |
| |CATHODE  |                                                                               |
| |WATER FLOW                                                                               |
| |SWITCH 18|                                                                               |
| |WFS18    |                                                                               |
| |  I:056  |                                                                               |
| |---|/|---|                                                                               |
| |   11    |                                                                               |
| |CATHODE  |                                                                               |
| |WATER FLOW                                                                               |
| |SWITCH 19|                                                                               |
| |WFS19    |                                                                               |
| |  I:056  |                                                                               |
| |---|/|---|                                                                               |
| |   12    |                                                                               |
| |CATHODE  |                                                                               |
| |WATER FLOW                                                                               |
| |SWITCH 20|                                                                               |
| |WFS20    |                                                                               |
| |  I:056  |                                                                               |
| |---|/|---|                                                                               |
| |   13    |                                                                               |
| |CATHODE  |                                                                               |
| |SHIELD   |                                                                               |
| |H2O FLOW |                                                                               |
| |SWITCH 17|                                                                               |
| |CSFS17   |                                                                               |
| |  I:055  |                                                                               |
| |---|/|---|                                                                               |
| |   04    |                                                                               |
| |CATHODE  |                                                                               |
| |SHIELD   |                                                                               |
| |H2O FLOW |                                                                               |
| |SWITCH 18|                                                                               |
| |CSFS18   |                                                                               |
| |  I:055  |                                                                               |
| +---|/|---+                                                                               |
|     05                                                                                    |
```

652

```
Rung #198
                                                                     CATHODE
                                                                     H2O FLOW
 CATHODE                                                             SWITCH
 WATER FLOW                                                          GROUP 6
 SWITCH 21                                                           FAULT
 WFS21                                                               CWFSG6F
    I:056                                                              B3
|----|/|---+-------------------------------------------------------------( )----|
|  |  14   |                                                            141
|  |       | B3/141 - -| |- - File #5 FAULTS - 202
|  |CATHODE  |
|  |WATER FLOW |
|  |SWITCH 22  |
|  |WFS22      |
|  |   I:056   |
|  |----|/|----|
|  |    15     |
|  |CATHODE    |
|  |WATER FLOW |
|  |SWITCH 23  |
|  |WFS23      |
|  |   I:056   |
|  |----|/|----|
|  |    16     |
|  |CATHODE    |
|  |WATER FLOW |
|   SWITCH 24  |
|  |WFS24      |
|  |   I:056   |
|  +----|/|----+
|       17
```

```
Rung #199
| HEATER                                                    HEATER SHIELD
| SHIELD H20                                                FLOW FAULT
| FLOW                                                      TIMER
| GROUP 1      PAUSE                                        HSFFTMR
| FAULT        DISABLE                                      +--TON------------+
| HSFG1F       TS12                                         |TIMER ON DELAY   |-(EN)-
|     B3         N7:16                                      |TIMER:      T4:93|
|-+---] [---+----]/[--------------------------------------- |BASE (SEC):   1.0|-(DN)
| |   216   |     4                                         |PRESET:        20|
| |[190]    |  [2:3]                                      |ACCUM:          0|
| |         |                                               +-----------------+
| |HEATER   |
| |SHIELD H20
| |FLOW     |
| |GROUP 2  |
| |FAULT    |
| |HSFG2F   |
| |    B3   |
| +---] [---+
| |   217   |
| |[191]    |
| |HEATER   |
| |SHIELD H20
| |FLOW     |
| |GROUP 3  |
| |FAULT    |
| |HSFG3F   |
| |    B3   |
| +---] [---+
|     218
|  [192]
T4:93.DN - -] [- - File #2 MAIN_PRGRM -  223
                   File #5 FAULTS -  200
T4:93.TT - -] [- - File #2 MAIN_PRGRM -  718
Rung #200
|                                                                 HEATER
|                                                                 SHIELD H20
|                                                                 FLOW FAULT
|                                                                 HSFF
|HSFFTMR                                                              B3
|  T4:93                                                         ---(L)---
|---] [-------------------------------------------------------------------|
|    DN                                                               219
|[199]
B3/219 - -] [- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  200
         -(U)- - File #5 FAULTS -  201
Rung #201
|                                                                 HEATER
 PAUSE                                                            SHIELD H20
|DISABLE                                                          FLOW FAULT
|TS12                                                             HSFF
|  N7:16                                                              B3
|---] [-------------------------------------------------------------(U)---|
|    4                                                                219
|[2:3]
B3/219 - -] [- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  200
         -(U)- - File #5 FAULTS -  201
```

Rung #202


CATHODE H2O FLOW SWITCH GROUP 1 FAULT CWFSG1F
B3
136
[193]
PAUSE DISABLE TS12
N7:16
4
[2:3]
CATHODE H2O FLOW SWITCH GROUP 2 FAULT CWFSG2F
B3
137
[194]
CATHODE H2O FLOW SWITCH GROUP 3 FAULT WFSG3F
B3
138
[195]
CATHODE H2O FLOW SWITCH GROUP 4 FAULT CWFSG4F
B3
139
[196]
CATHODE H2O FLOW SWITCH GROUP 5 FAULT CWFSG5F
B3
140
[197]
CATHODE H2O FLOW SWITCH GROUP 6 FAULT CWFSG6F
B3
141
[198]
CATHODE FLOW FAULT TIMER CFFTMR
TON
TIMER ON DELAY
TIMER: T4:94
BASE (SEC): 1.0
PRESET: 20
ACCUM: 0
(EN)
(DN)

```
T4:94.DN - -| |- - File #5 FAULTS -  203
T4:94.TT - -| |- - File #2 MAIN_PRGRM -  718
Rung #203
|                                                                  CATHODE  |
|                                                                  H2O FLOW |
|                                                                  FAULT    |
|CFFTMR                                                            CWFF     |
| T4:94                                                               B3    |
|--| |---------------------------------------------------------------(L)----|
|  DN                                                                 220   |
|[202]                                                                      |
B3/220 - -| |- - File #2 MAIN_PRGRM -  625
        -(L)- - File #5 FAULTS -  203
        -(U)- - File #5 FAULTS -  204
Rung #204
|                                                                  CATHODE  |
|PAUSE                                                             H2O FLOW |
|DISABLE                                                           FAULT    |
|TS12                                                              CWFF     |
| N7:16                                                               B3    |
|--| |---------------------------------------------------------------(U)----|
|  4                                                                  220   |
|[2:3]                                                                      |
B3/220 - -| |- - File #2 MAIN_PRGRM -  625
        -(L)- - File #5 FAULTS -  203
        -(U)- - File #5 FAULTS -  204
Rung #205
   UNI     PIRANI   PIRINI   PIRINI   PIRINI   PIRINI   PIRINI   PIRINI              PIRINI   |
|GUAGE 1   GUAGE 2  GUAGE 3  GUAGE 4  GUAGE 5  GUAGE 6  GUAGE 7  GUAGE 8             GUAGE NO |
|NO FAULT  NO FAULT NO FAULT NO FAULT NO FAULT NO FAULT NO FAULT NO FAULT            FAULT    |
|PGNF1     PGNF2    PGNF3    PGNF4    PGNF5    PGNF6    PGNF7    PGNF8               PGNF     |
| I:004    I:004    I:024    I:024    I:040    I:040    I:054    I:054                  B3    |
|--| |------| |------| |------| |------| |------| |------| |------| |-----------------( )----|
|  14       15       14       15       14       15       14       15                   465   |
B3/465 - -| |- - File #2 MAIN_PRGRM -  23
        -|/|- - File #2 MAIN_PRGRM -  22,624
        -( )- - File #5 FAULTS -  205
Rung #206
|CHAMBER CHAMBER CHAMBER CHAMBER  CHAMBER  CHAMBER                   ALL CHAMBER    |
|COVER 5 COVER 6 COVER 9 COVER 10 COVER 11 COVER 12                  COVERS CLOSED  |
|CC5     CC6     CC9     CC10     CC11     CC12                      ACCC           |
| I:025   I:025   I:041   I:041    I:055    I:055                       B3         |
|--| |-----| |-----| |-----| |------| |------| |---------------------------( )------|
|  00      01      00      01       00       01                          315        |
B3/315 - -|/|- - File #5 FAULTS -  207
        -( )- - File #5 FAULTS -  206
Rung #207
|                                                                  CHAMBER  |
|ALL CHAMBER                                                       COVERS   |
|  ERS CLOSED                                                      CLOSED   |
|ACCC                                                              CCC      |
|       B3                                                            B3    |
|------|/|-----------------------------------------------------------(L)----|
|       315                                                           467   |
|[206]                                                                      |
B3/467 - -| |- - File #2 MAIN_PRGRM -  626
        -(L)- - File #5 FAULTS -  207
        -(U)- - File #5 FAULTS -  208
```

656

```
Rung #208
|                                                                              CHAMBER |
|PAUSE                                                                         COVERS  |
|DISABLE                                                                       CLOSED  |
|TS12                                                                          CCC     |
| N7:16                                                                          B3    |
|--] [-----------------------------------------------------------------------(U)-------|
|   4                                                                            467   |
|[2:3]                                                                                 |
B3/467 - ] [ - - File #2 MAIN_PRGRM -  626
         -(L)- - File #5 FAULTS -  207
         -(U)- - File #5 FAULTS -  208
Rung #209
|                                                                RETURN TO MAIN     |
|                                                                FROM_CRYO_RGN      |
|                                                                +--RET-----------+ |
|----------------------------------------------------------------+RETURN ()       +-|
|                                                                +----------------+ |
Rung #210
|------------------------------------------------------------------------------[END]-|
```

Rung #000

Description	Address	Bit	Ref
MECHANICAL PUMP 1 ENABLED MP1	0:007	00	[2:68]
BLOWER 1 ENABLED BL1	0:007	01	[2:69]
MECHANICAL PUMP 2 ENABLED MP2	0:027	00	[2:73]
BLOWER 2 ENABLED BL2	0:027	01	[2:74]
MECHANICAL PUMP 3 ENABLED MP3	0:057	00	[2:78]
BLOWER 3 ENABLED BL3	0:057	01	[2:79]
OPEN LOAD LOCK ROUGH VALVE RV1	0:010	11	[2:167]
OPEN DWELL 2 ROUGH VALVE RV2	0:030	11	[2:56]
OPEN DWELL 4 ROUGH VALVE RV3	0:044	11	[2:57]
OPEN DWELL 6 ROUGH VALVE RV4	0:060	11	[2:58]
OPEN EXLOCK ROUGH VALVE RV5	0:060	12	[2:340]
OPEN LOAD LOCK CHAMBER VENT VALVE CV1	0:007	16	[2:173]
OPEN DWELL 2 VENT VALVE CV2	0:007	17	[2:396]
OPEN DWELL 3 VENT VALVE CV3	0:027	16	[2:401]
OPEN DWELL 5 VENT VALVE CV4	0:043	16	[2:403]
OPEN EXLOCK CHAMBER VENT VALVE CV5	0:057	16	[2:346]
( )	B3	9	

B3/9 - -( )- - File #6 TECH_RUNGS - 0,1

Rung #001

Description	Address	Bit	Ref
ROUGHING SECTION 1 PRESSURE PS1	I:002	03	
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2	I:002	04	
DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE PS3	I:002	05	
DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE PS4	I:022	04	
DWELL 5 CHAMBER PRESSUR AT ATMOSPHERE PS5	I:036	04	
OPEN PUMP 1 VENT VALVE PV1	0:007	02	[2:59]
OPEN PUMP 2 VENT VALVE PV2	0:027	02	[2:60]
OPEN PUMP 3 VENT VALVE PV3	0:057	02	[2:61]
( )	B3	9	

B3/9 - -( )- - File #6 TECH_RUNGS - 0

Rung #002

Description	Address	Bit	Ref
DOOR CLOSE SOLENOID 1 ENABLE DRCL1	0:011	00	[2:183]
OPEN DOOR 1 DROP1	0:011	01	[2:181]
DOOR CLOSE SOLENOID 2 ENABLE DRCL2	0:011	02	[2:202]
OPEN DOOR SOLENOID 2 ENABLE DROP2	0:011	03	[2:200]
CLOSE DOOR 3 DRCL3	0:011	04	[2:229]
DOOR OPEN SOLENOID 3 ENABLE DROP3	0:011	05	[2:216]
DOOR CLOSE SOLENOID 4 ENABLE DRCL4	0:011	06	[2:408]
DOOR OPEN SOLENOID 4 ENABLE DROP4	0:011	07	[2:415]
DOOR CLOSE SOLENOID 5 ENABLE DRCL5	0:031	00	[2:414]
DOOR OPEN SOLENOID 5 ENABLE DROP5	0:031	01	[2:46]
DOOR CLOSE SOLENOID 6 ENABLE DRCL6	0:031	02	[2:420]
DOOR OPEN SOLENOID 6 ENABLE DROP6	0:031	03	[2:47]
DUMMY TEMP5 ( )	B3	5	

Pung #003

Description	Address	Bit	Ref
DOOR CLOSE SOLENOID 7 ENABLE DRCL7	0:045	00	[2:422]
DOOR OPEN SOLENOID 7 ENABLE DROP7	0:045	01	[2:48]
DOOR CLOSE SOLENOID 8 ENABLE DRCL8	0:045	02	[2:427]
DOOR OPEN SOLENOID 8 ENABLE DROP8	0:045	03	[2:49]
CLOSE DOOR 9 SOLENOID ENABLE DRCL9	0:061	00	[2:329]
DOOR OPEN SOLENOID 9 ENABLE DROP9	0:061	01	[2:325]
CLOSE DOOR 10 ENABLE DRCL10	0:061	02	[2:335]
DOOR OPEN SOLENOID 10 ENABLE DROP10	0:061	03	[2:326]
CLOSE DOOR 11 DRCL11	0:061	04	[2:337]
DOOR OPEN SOLENOID 11 ENABLE DROP11	0:061	05	[2:327]
DOOR CLOSE SOLENOID12 ENABLE DRCL12	0:061	06	[2:353]
DUMMY TEMP6 ( )	B3	6	

Rung #004

DOOR 1 OPEN DROP1S	DOOR 2 OPEN DROP2S	DOOR 3 OPEN DROP3S	DOOR 4 OPEN DROP4S	DOOR 5 OPEN DROP5S	DUMMY DUMMY B3
I:006 01	I:006 03	I:006 05	I:006 07	I:026 01	( ) 30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,11,12,13

Rung #005

DOOR 1 CLOSED DRCL1S	DOOR 2 CLOSED DRCL2S	DOOR 3 CLOSED DRCL3S	DOOR 4 CLOSED DRCL4S	DOOR 5 CLOSED DRCL5S	DOOR 6 CLOSED DRCL6S	DOOR 7 CLOSED DRCL7S	DOOR 8 CLOSED DRCL8S	DOOR 9 CLOSED DRCL9S	DOOR 10 CLOSED DRCL10S	DOOR 11 CLOSED DRCL11S	DOOR 12 CLOSED DRCL12S	TEMP DUMMY_97 B3
I:006 00	I:006 02	I:006 04	I:006 06	I:026 00	I:026 02	I:042 00	I:042 02	I:056 00	I:056 02	I:056 04	I:056 06	( ) 97

Rung #006

CRYO GATE HEATER 1 CHAMBER HV1	CRYO GATE SOLENOID 1 HEATER 2 CHAMBER HV2_1	CRYO GATE SOLENOID 2 HEATER 2 CHAMBER HV2_2	CRYO GATE SOLENOID 1 DWELL 1 CHAMBER HV3_1	CRYO GATE SOLENOID 2 DWELL 1 CHAMBER HV3_2	CRYO GATE SOLENOID 1 DWELL 2 CHAMBER HV4_1	CRYO GATE SOLENOID 2 DWELL 2 CHAMBER HV4_2	CRYO GATE SOLENOID 1 HEATER 2 CHAMBER HV5_1	CRYO GATE SOLENOID 2 HEATER 2 CHAMBER HV5_2	CRYO GATE SOLENOID 1 DWELL 3 CHAMBER HV6_1	CRYO GATE SOLENOID 2 DWELL 3 CHAMBER HV6_2
0:011 11 [2:115]	0:011 13 [2:117]	0:011 14 [2:118]	0:011 15 [2:119]	0:011 16 [2:120]	0:031 11 [2:121]	0:031 12 [2:122]	0:031 13 [2:123]	0:031 14 [2:124]	0:031 15 [2:125]	0:031 16 [2:126]

CRYO GATE SOLENOID 1 DWELL 4 CHAMBER HV7_1	CHROME HI POWER SUPPLY 1 OUTPUT CHRPS1	CHROME HI POWER SUPPLY 3 OUTPUT CHRPS3	MAGNETIC HI POWER SUPPLY 1 OUTPUT MAGPS1	MAGNETIC HI POWER SUPPLY 3 OUTPUT MAGPS3	CARBON HI POWER SUPPLY 1 OUTPUT CARPS1	CARBON HI POWER SUPPLY 3 OUTPUT CARPS3	DUMMY TEMP7 B3
0:045 11 [2:127]	0:033 10 [2:236]	0:033 12 [2:242]	0:033 14 [2:268]	0:063 10 [2:274]	0:063 12 [2:299]	0:063 14 [2:300]	( ) 7

B3/7 - -( )- - File #6 TECH_RUNGS - 6,7

Rung #007

CRYO GATE SOLENOID 2 DWELL 4 CHAMBER HV7_2	CRYO GATE SOLENOID 1 BUFFER 3 CHAMBER HV8_1	CRYO GATE SOLENOID 2 BUFFER 3 CHAMBER HV8_2	CRYO GATE SOLENOID 1 DWELL 5 CHAMBER HV9_1	CRYO GATE SOLENOID 2 DWELL 5 CHAMBER HV9_2	CRYO GATE SOLENOID 1 DWELL 6 CHAMBER HV10_1	CRYO GATE SOLENOID 2 DWELL 6 CHAMBER HV10_2	CRYO GATE SOLENOID 1 BUFFER 4 CHAMBER HV11_1	CRYO GATE SOLENOID 2 BUFFER 4 CHAMBER HV11_2	CRYO GATE SOLENOID 1 EXBUFFER CHAMBER HV12_1
0:045 12 [2:128]	0:045 13 [2:129]	0:045 14 [2:130]	0:045 15 [2:131]	0:045 16 [2:132]	0:061 11 [2:133]	0:061 12 [2:134]	0:061 13 [2:135]	0:061 14 [2:136]	0:061 15 [2:137]

CRYO GATE SOLENOID 2 EXBUFFER CHAMBER HV12_2	OPEN RGA ISOLATION VALVE 1 RGAV1	OPEN RGA ISOLATION VALVE 2 RGAV2	OPEN RGA ISOLATION VALVE 3 RGAV3	OPEN RGA ISOLATION VALVE 4 RGAV4	OPEN CAPACITANC MANOMETER ISOLATION VALVE 1 CMV1	OPEN CAPACITANC MANOMETER ISOLATION VALVE 2 CMV2	OPEN CAPACITANC MANOMETER ISOLATION VALVE 3 CMV3	OPEN CAPACITANC MANOMETER ISOLATION VALVE 4 CMV4	CRYO GA SOLENOI DWELL 4 CHAMBER HV7_2
0:061 16 [2:138]	0:010 13 [2:371]	0:030 13 [2:372]	0:044 13 [2:373]	0:060 13 [2:374]	0:010 06 [2:375]	0:030 06 [2:376]	0:044 06 [2:377]	0:060 06 [2:378]	0:04 12 [2:128]

B3/7 - -( )- - File #6 TECH_RUNGS - 6

Rung #008

HEATER 1 CHAMBER GATE VALVE CLOSE	HEATER 2 CHAMBER GATE VALVE CLOSE	DWELL 1 CHAMBER GATE VALVE CLOSED	DWELL 2 CHAMBER GATE VALVE CLOSED	HEATER 3 CHAMBER GATE VALVE CLOSED	DWELL 3 CHAMBER GATE VALVE CLOSED	DWELL 4 CHAMBER GATE VALVE CLOSED	BUFFER 3 CHAMBER GATE VALVE CLOSED	DWELL 5 CHAMBER GATE VALVE CLOSED	DWELL 6 CHAMBER GATE VALVE CLOSED
HV1S1	HV2S1	HV3S1	HV4S1	HV5S1	HV6S1	HV7S1	HV8S1	HV9S1	HV10S1
I:002	I:004	I:004	I:022	I:024	I:024	I:036	I:040	I:040	I:052
06	00	03	06	00	03	06	00	03	06

BUFFER 4 CHAMBER GATE VALVE CLOSED	EXITLOCK CHAMBER GATE VALVE CLOSED	DUMMY
HV11S1	HV12S1	DUMMY
I:054	I:054	B3
00	03	( ) 30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,9,10,11,12,13

Rung #009

HEATER 2 CHAMBER GATE VALVE THROTTLED	DWELL 1 CHAMBER GATE VALVE THROTTLED	DWELL 2 CHAMBER GATE VALVE THROTTLED	HEATER 3 CHAMBER GATE VALVE THROTTLED	DWELL 3 CHAMBER GATE VALVE THROTTLED	DWELL 4 CHAMBER GATE VALVE THROTTLED	BUFFER 3 CHAMBER GATE VALVE THROTTLED	DWELL 5 CHAMBER GATE VALVE THROTTLED	DWELL 6 CHAMBER GATE VALVE THROTTLED	BUFFER 4 CHAMBER GATE VALVE THROTTLED
HV2S2	HV3S2	HV4S2	HV5S2	HV6S2	HV7S2	HV8S2	HV9S2	HV10S2	HV11S2
I:004	I:004	I:022	I:024	I:024	I:036	I:040	I:040	I:052	I:054
01	04	07	01	04	07	01	04	07	01

EXIT BUFFER GATE VALVE THROTTLED	DUMMY
HV12S2	DUMMY
I:054	B3
04	( ) 30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,10,11,12,13

Rung #010

HEATER 1 CHAMBER GATE VALVE OPEN	HEATER 2 CHAMBER GATE VALVE OPEN	DWELL 1 CHAMBER GATE VALVE OPEN	DWELL 2 CHAMBER GATE VALVE OPEN	HEATER 3 CHAMBER GATE VALVE OPEN	DWELL 3 CHAMBER GATE VALVE OPEN	DWELL 4 CHAMBER GATE VALVE OPEN	BUFFER 3 CHAMBER GATE VALVE OPEN	DWELL 5 CHAMBER GATE VALVE OPEN	DWELL 6 CHAMBER GATE VALVE OPEN
HV1S3	HV2S3	HV3S3	HV4S3	HV5S3	HV6S3	HV7S3	HV8S3	HV9S3	HV10S3
I:002	I:004	I:004	I:022	I:024	I:024	I:036	I:040	I:040	I:052
10	02	05	10	02	05	10	02	05	10

BUFFER 4 CHAMBER GATE VALVE OPEN	EXIT BUFFER GATE VALVE OPEN	DUMMY
HV11S3	HV12S3	DUMMY
I:054	I:054	B3
02	05	( ) 30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,11,12,13

Rung #011

PALLET DETECTED LEFT SIDE ENTRANCE	PALLET DETECTED CENTER ENTRANCE	PALLET DETECTED RIGHT SIDE ENTRANCE	PALLET DETECTED LEFT SIDE LOADLOCK	PALLET DETECTED CENTER LOADLOCK	PALLET DETECTED RIGHT SIDE LOADLOCK	PALLET DETECTED LEFT SIDE HEATER 1	PALLET DETECTED CENTER HEATER 1	PALLET DETECTED RIGHT SIDE HEATER 1	PALLET DETECTED LEFT SIDE HEATER 2	PALLET DETECTED CENTER BUFFER 1
SEN1	SEN2	SEN3	SEN4	SEN5	SEN6	SEN7	SEN8	SEN9	SEN10	SEN11
I:003	I:003	I:003	I:003	I:003	I:003	I:003	I:003	I:003	I:003	I:003
00	01	02	03	04	05	06	07	10	11	12

660

PALLET DETECTED RIGHT SIDE HEATER 2 SEN12	PALLET DETECTED LEFT SIDE DWELL 1 SEN13	PALLLET DETECTED CENTER DWELL 1 SEN14	PALLET DETECTED RIGHT SIDE DWELL 1 SEN15	PALLET DETECTED LEFT SIDE CHROME SEN16	PALLET DETECTED CENTER CHROME SEN17	PALLET DETECTED RIGHT SIDE CHROME SEN18	DUMMY DUMMY
I:003	I:003	I:003	I:003	I:023	I:023	I:023	B3
—| |— 13	—| |— 14	—| |— 15	—| |— 16	—| |— 00	—| |— 01	—| |— 02	—( )— 30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,12,13

Rung #012

PALLET DETECTED LEFT SIDE DWELL 2 SEN19	PALLET DETECTED CENTER DWELL 2 SEN20	PALLET DETECTED RIGHT SIDE DWELL 2 SEN21	PALLET DETECTED LEFT SIDE HEATER 3 SEN22	PALLET DETECTED RIGHT SIDE HEATER 3 SEN24	PALLET DETECTED LEFT SIDE DWELL 3 SEN25	PALLET DETECTED CENTER DWELL 3 SEN26	PALLET DETECTED RIGHT SIDE DWELL 3 SEN27	PALLET DETECTED LEFT SIDE MAGNETIC SEN28	PALLET DETECTED CENTER MAGNETIC SEN29	PALLET DETECTED RIGHT SIDE MAGNETIC SEN30
I:023	I:023	I:023	I:023	I:023	I:023	I:023	I:023	I:037	I:037	I:037
—| |— 03	—| |— 04	—| |— 05	—| |— 06	—| |— 10	—| |— 11	—| |— 12	—| |— 13	—| |— 00	—| |— 01	—| |— 02

PALLET DETECTED LEFT SIDE DWELL 4 SEN31	PALLET DETECTED MIDDLE DWELL 4 SEN32	PALLET DETECTED RIGHT SIDE DWELL 4 SEN33	PALLET DETECTED LEFT SIDE BUFFER 3 SEN34	PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36	DUMMY DUMMY
I:037	I:037	I:037	I:037	I:037	B3
—| |— 03	—| |— 04	—| |— 05	—| |— 06	—| |— 10	—( )— 30

:0 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,11,13

Rung #013

PALLET DETECTED LEFT SIDE DWELL 5 SEN37	PALLET DETECTED CENTER DWELL 5 SEN38	PALLET DETECTED RIGHT SIDE DWELL 5 SEN39	PALLET DETECTED LEFT SIDE CARBON SEN40	PALLET DETECTED CENTER CARBON SEN41	PALLET DETECTED RIGHT SIDE CARBON SEN42	PALLET DETECTED LEFT SIDE DWELL 6 SEN43	PALLET DETECTED CENTER DWELL 6 SEN44	PALLET DETECTED RIGHT SIDE DWELL 6 SEN45	PALLET DETECTED LEFT SIDE BUFFER 4 SEN46	PALLET DETECTED RIGHT SIDE BUFFER 4 SEN48
I:037	I:037	I:037	I:053	I:053	I:053	I:053	I:053	I:053	I:053	I:053
—| |— 11	—| |— 12	—| |— 13	—| |— 00	—| |— 01	—| |— 02	—| |— 03	—| |— 04	—| |— 05	—| |— 06	—| |— 10

PALLET DETECTED LEFT SIDE EXBUFFER SEN49	PALLET DETECTED RIGHT SIDE EXBUFFER SEN51	PALLET DETECTED LEFT SIDE EXIT LOCK SEN52	PALLET DETECTED RIGHT SIDE EXLOCK SEN54	PALLET DETECTED LEFT SIDE EXIT END SEN55	PALLET DETECTED CENTER EXIT END SEN56	PALLET DETECTED RIGHT SIDE EXIT END SEN57	DUMMY DUMMY
I:053	I:053	I:053	I:053	I:053	I:054	I:054	B3
—| |— 11	—| |— 13	—| |— 14	—| |— 16	—| |— 17	—| |— 16	—| |— 17	—( )— 30

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Rung #014

COMPRESSOR 1 REGEN-ATION PROGRAM CYRGN1	COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2	COMPRESSOR 3 REGEN-ERATION PROGRAM CYRGN3	COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4	COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5	COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6	COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7	COMPRESSOR 8 REGEN-ERATION PROGRAM CYRGN8	OPEN CRYO ROUGH VALVE 1 CR1	OPEN CRYO ROUGH VALVE 2 CR2
B3	B3	B3	B3	B3	B3	B3	B3	0:007	0:007
—| |— 321	—| |— 322	—| |— 323	—| |— 324	—| |— 325	—| |— 326	—| |— 327	—| |— 328	—| |— 11	—| |— 12
[3:0]	[3:34]	[3:38]	[3:42]	[3:46]	[3:52]	[3:57]	[3:63]	[3:15]	[3:164]

OPEN CRYO ROUGH VALVE 3 CR3	OPEN CRYO ROUGH VALVE 4 CR4	OPEN CRYO ROUGH VALVE 5 CR5	OPEN CRYO ROUGH VALVE 6 CR6	OPEN CRYO ROUGH VALVE 7 CR7	OPEN CRYO ROUGH VALVE 8 CR8	OPEN CRYO ROUGH VALVE 9 CR9	OPEN CRYO ROUGH VALVE 10 CR10	OPEN CRYO ROU VALVE 11 CR11	COMPRESSOR 1 REGEN-ERATION PROGRAM CYRGN1	COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2
0:007	0:027	0:027	0:027	0:043	0:043	0:043	0:057	0:057	B3	B3
									—| |—	—| |—

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13	11	12	13	11	12	13	11	12	321	322
[3:165]	[3:167]	[3:166]	[3:168]	[3:169]	[3:170]	[3:171]	[3:172]	[3:174]	[3:0]	[3:34]

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Rung #015

PURGE 1 P1	PURGE 2 P2	PURGE 3 P3	PURGE 4 P4	PURGE 5 P5	PURGE 6 P6	PURGE 7 P7	PURGE 8 P8	PGC1	PGC2	PGC3	PURGING TIME PGC4	PURGING TIME 5 PGC5	PGC6	PGC7
B3	B3	B3	B3	B3	B3	B3	B3	T4:21	T4:22	T4:23	T4:24	T4:25	T4:26	T4:27
631	632	633	634	635	636	637	638	TT	TT	TT	TT	TT	TT	TT
[3:5]	[3:74]	[3:75]	[3:76]	[3:77]	[3:78]	[3:79]	[3:80]	[3:9]	[3:110]	[3:111]	[3:112]	[3:113]	[3:114]	[3:115]

PGC8	MECHANICAL PUMP 2 ENABLED MP2	BLOWER 2 ENABLED BL2	LINE PRESSURE MADE-TC10 LPM-TC10	TEMP TEMP15
T4:28	0:027	0:027	B3	B3
TT	00	01	250	( ) 15
[3:116]	[2:73]	[2:74]	[2:671]	

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Rung #016

OPEN PURGE VALVE 1 NIF1	OPEN PURGE VALVE 2 NIF2	OPEN PURGE VALVE 3 NIF3	OPEN PURGE VALVE 4 NIF4	OPEN PURGE VALVE 5 NIF5	OPEN PURGE VALVE 6 NIF6	OPEN PURGE VALVE 7 NIF7	OPEN PURGE VALVE 8 NIF8	OPEN PURGE VALVE 9 NIF9	OPEN PURGE VALVE 10 NIF10
0:007	0:007	0:007	0:027	0:027	0:027	0:043	0:043	0:043	0:057
06	07	10	06	07	10	06	07	10	06
[3:7]	[3:88]	[3:89]	[3:91]	[3:90]	[3:92]	[3:93]	[3:94]	[3:95]	[3:96]

OPEN PURGE VALVE 11 NIF11	OPEN PURGE VALVE 12 NIF12	CRYO RE-GENERATION FAULT COMPRESSOR 1 CRFLT1	CRYO RE-GENERATION FAULT COMPRESSOR 2 CRFLT2	CRYO RE-GENERATION FAULT COMPRESSOR 3 CRFLT3	CRYO RE-GENERATION FAULT COMPRESSOR 4 CRFLT4	CRYO RE-GENERATION FAULT COMPRESSOR 5 CRFLT5	CRYO RE-GENERATION FAULT COMPRESSOR 6 CRFLT6	CRYO RE-GENERATI FAULT COMPRESS 7 CRFLT7	OPEN PURGE VALVE 1 NIF1	OPEN PURGE VALVE 2 NIF2
0:057	0:057	B3	B3	B3	B3	B3	B3	B3	0:007	0:007
07	10	331	332	333	334	335	336	337	06	07
[3:98]	[3:97]	[3:30]	[3:252]	[3:253]	[3:254]	[3:255]	[3:256]	[3:257]	[3:7]	[3:88]

Rung #017

ROUGHING AND ROR 1 R&ROR1	ROUGHING AND ROR 2 R&ROR2	ROUGHING AND ROR 3 R&ROR3	ROUGHING AND ROR 4 R&ROR4	ROUGHING AND ROR 5 R&ROR5	ROUGHING AND ROR 6 R&ROR6	ROUGHING AND ROR 7 R&ROR7	ROUGHING AND ROR 8 R&ROR8	COMPRESSOR 1 ROR LATCH CY1RORL	COMPRESSOR 2 ROR LATCH CY2RORL	COMPRESSOR 3 ROR LATCH CY3RORL
B3	B3	B3	B3	B3	B3	B3	B3	B3	B3	B3
641	642	643	644	645	646	647	648	601	602	603
[3:11]	[3:128]	[3:129]	[3:130]	[3:131]	[3:132]	[3:133]	[3:134]	[3:16]	[3:175]	[3:177]

COMPRESSOR 4 ROR LATCH CY4RORL	COMPRESSOR 5 ROR LATCH CY5RORL	COMPRESSOR 6 ROR LATCH CY6RORL	COMPRESSOR 7 ROR LATCH CY7RORL	COMPRESSOR 8 ROR LATCH CY8RORL	MECHANICAL PUMP 2 TC=<50 MICRONS PIR10	TEMP TEMP15
B3	B3	B3	B3	B3	I:024	B3
604	605	606	607	608	13	( ) 15
[3:179]	[3:181]	[3:183]	[3:185]	[3:187]		

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Rung #018
|CRYO 1       CRYO 2       CRYO 3       CRYO 4       CRYO 5       CRYO 6       CRYO 7       CRYO 8       CRYO 9       CRYO 10
|THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL   THERMCOUPL
|50 MICRON    50 MICRON    50 MICRON    50 MICRON    50 MICRON    50 MICRON    50 MICRON    50 MICRON    50 MICRON    50 MICRON
|PIR3         PIR4         PIR5         PIR7         PIR8         PIR9         PIR12        PIR13        PIR14        PIR18
|  I:004        I:004        I:004        I:024        I:024        I:024        I:040        I:040        I:040        I:054
|--] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--
|   11           12           13           10           11           12           10           11           12           11
| B3/16 - -( )- - File #6 TECH_RUNGS - 22
                                                                                                                         |CRYO 1
     CRYO 11      CRYO 12                                                                                             |THERMCOU
     THERMCOUPL   THERMCOUPL                                                                                          |50 MICRO
     50 MICRON    50 MICRON                                                                                           |PIR3
     PIR19        PIR20       C1RORTMR   C2RORTMR   C3RORTMR   C4RORTMR   C5RORTMR   C6RORTMR   C7RORTMR   C8RORTMR    |  I:004
       I:054        I:054       T4:31      T4:32      T4:33      T4:34      T4:35      T4:36      T4:37      T4:38     |--] [-
   ----] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [-------|   11
        12           13          TT         TT         TT         TT         TT         TT         TT         TT      |
                               [3:18]     [3:189]    [3:190]    [3:191]    [3:192]    [3:193]    [3:194]    [3:195]   | B3/16 -

Rung #019
|                                                                                            ENABLE       ENABLE       ENABLE
|                                                                                            CRYO         CRYO         CRYO
|COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN      COMPRESSOR   COMPRESSOR   COMPRESSOR
|1          2          3          4          5          6          7          8              1            2            3
|CD1        CD2        CD3        CD4        CD5        CD6        CD7        CD8            CY1          CY2          CY3
|  B3         B3         B3         B3         B3         B3         B3         B3           O:010        O:010        O:030
|--] [------] [------] [------] [------] [------] [------] [------] [------] [-------------] [----------] [----------] [--
|  651        652        653        654        655        656        657        658            04           05           04
  20]       [3:203]    [3:204]    [3:205]    [3:206]    [3:207]    [3:208]    [3:209]        [2:26]       [2:27]       [2:28]
                                                     ENABLE       ENABLE       ENABLE       ENABLE       ENABLE                |
                                                     CRYO         CRYO         CRYO         CRYO         CRYO                  |
                                                     COMPRESSOR   COMPRESSOR   COMPRESSOR   COMPRESSOR   COMPRESSOR            |
                                                     4            5            6            7            8          TEMP 20   |
                                                     CY4          CY5          CY6          CY7          CY8        TMP20     |
                                                       O:030        O:044        O:044        O:060        O:060      B3      |
                                                   ----] [--------] [--------] [--------] [--------] [---------( )-----|
                                                         05           04           05           04           05         20     |
                                                     [2:29]       [2:30]       [2:31]       [2:32]       [2:33]                  |

Rung #020
|CYRO 1      CRYO 2      CRYO 3      CRYO 4      CRYO 5      CRYO 6      CRYO 7      CRYO 8      CRYO 9      CYRO 10
|TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR
|=>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K
|CY1TMP290   CY2TMP290   CY3TMP290   CY4TMP290   CY5TMP290   CY6TMP290   CY7TMP290   CY8TMP290   CY9TMP290   CY10TMP290
|  B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|--] [-------] [-------] [-------] [-------] [-------] [-------] [-------] [-------] [-------] [--
|  513         514         515         516         517         518         519         520         521         522
                                                                                                  CRYO 11     CRYO 12          |
                                                                                                  TEMPERATUR  TEMPERATUR       |
                                                                                                  =>290K      =>290K           |
                                                                                                  CY11TMP290  CY12TMP290       |
                                                                                                    B3          B3         B3  |
                                                                                                ----] [-------] [-------( )-|
                                                                                                    523         524        25  |

Rung #021
|CRYO 1      CRYO 2      CRYO 3      CRYO 4      CRYO 5      CRYO 6      CRYO 7      CRYO 8      CRYO 9      CRYO 10
|TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR
|=<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K
|CY1TMP20    CY2TMP20    CY3TMP20    CY4TMP20    CY5TMP20    CY6TMP20    CY7TMP20    CY8TMP20    CY9TMP20    CY10TMP20
|  B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|--] [-------] [-------] [-------] [-------] [-------] [-------] [-------] [-------] [-------] [--
|  501         502         503         504         505         506         507         508         509         510
                                                                                              CRYO 11     CRYO 12          |
                                                                                              TEMPERATUR  TEMPERATUR       |
                                                                                              =<20K       =<20K    TEMP 21 |
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SECTION N

CA -- GENERAL CALCULATION

TAG	EL	EH	ET	RN	OUTPUT	B	C	D	E	F	G	H	NX	CP
TD2CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD2M	TD2B	0.0000	0.0000	0.0000	0.00	0.00	TD2AB	.
TD3CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD3M	TD3B	0.0000	0.0000	0.0000	0.00	0.00	TD3AB	.
TD4CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD4M	TD4B	0.0000	0.0000	0.0000	0.00	0.00	TD4AB	.
TD5CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD5M	TD5B	0.0000	0.0000	0.0000	0.00	0.00	TD5AB	.
TD6CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD6M	TD6B	0.0000	0.0000	0.0000	0.00	0.00	TD6AB	.
TD7CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD7M	TD7B	0.0000	0.0000	0.0000	0.00	0.00	TD7AB	.
TD8CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD8M	TD8B	0.0000	0.0000	0.0000	0.00	0.00	TD8AB	.
TD9CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD9M	TD9B	0.0000	0.0000	0.0000	0.00	0.00	TD9AB	.
TD10CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD10M	TD10B	0.0000	0.0000	0.0000	0.00	0.00	TD10AB	.
TD11CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD11M	TD11B	0.0000	0.0000	0.0000	0.00	0.00	TD11AB	.
TD12CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD12M	TD12B	0.0000	0.0000	0.0000	0.00	0.00	TD12AB	.
TD1CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD1M	TD1B	0.0000	0.0000	0.0000	0.00	0.00	TD1AB	.
HCAL1	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP1	100.00	1000.0	0.00	0.00	0.00	.	
HCAL2	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP2	100.00	1000.0	0.00	0.00	0.00	.	
HCAL3	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP3	100.00	1000.0	0.00	0.00	0.00	.	
HCAL4	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP4	100.00	1000.0	0.00	0.00	0.00	.	
HCAL5	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP5	100.00	1000.0	0.00	0.00	0.00	.	
HCAL6	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP6	100.00	1000.0	0.00	0.00	0.00	.	
HCAL7	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP7	100.00	1000.0	0.00	0.00	0.00	.	
HCAL8	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP8	100.00	1000.0	0.00	0.00	0.00	.	
OCALC1A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	PSSP1A	.
OCALC2A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF2	0.00	0.00	0.00	0.00	0.00	0.00	PSSP2A	.
OCALC3A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	PSSP3A	.
OCALC4A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	PSSP4A	.
OCALC1B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	PSSP1B	.
OCALC2B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF2	0.00	0.00	0.00	0.00	0.00	0.00	PSSP2B	.
OCALC3B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	PSSP3B	.
OCALC4B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	PSSP4B	.
OCALC5A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	PSSP5A	.
OCALC6A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	PSSP6A	.
OCALC5B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	PSSP5B	.
OCALC6B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	PSSP6B	.
OCALC7A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	PSSP7A	.
OCALC8A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	PSSP8A	.
OCALC7B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	PSSP7B	.
OCALC8B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	PSSP8B	.
OCALC9A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	PSSP9A	.
OCALC10A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	PSSP10A	.
OCALC11A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	PSSP11A	.
OCALC12A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	PSSP12A	.
OCALC9B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	PSSP9B	.
OCALC10B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	PSSP10B	.
OCALC11B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	PSSP11B	.
OCALC12B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	PSSP12B	.
ICALC2A	0.0	40.0	PCT	Y	OUTPUT = (A/B)	PSF2	0.0000	0.00	0.00	0.00	0.00	0.00	.	
ICALC1A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	.	

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PCT/US 92/00722

ICALC3A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	.	
TAG	EL	EH	ET	RN	OUTPUT	B	C	D	E	F	G	H	NX	CP
ICALC4A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC1B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC2B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF2	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC3B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC4B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC5A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC6A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC5B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC6B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC7A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC8A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC7B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC8B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC9A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC10A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC11A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC12A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC9B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC10B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC11B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC12B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	.	
HV1CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	0.00	100.00	HV1S3	1000.0	0.00	0.00	HV1ANA	.
HV2CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV2S2	100.00	HV2S3	1000.0	0.00	0.00	HV2ANA	.
DR1CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP1S	1000.0	0.00	0.00	0.00	0.00	DR1ANA	.
HV3CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV3S2	100.00	HV3S3	1000.0	0.00	0.00	HV3ANA	.
HV4CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV4S2	100.00	HV4S3	1000.0	0.00	0.00	HV4ANA	.
HV5CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV5S2	100.00	HV5S3	1000.0	0.00	0.00	HV5ANA	.
HV6CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV6S2	100.00	HV6S3	1000.0	0.00	0.00	HV6ANA	.
DR2CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP2S	1000.0	0.00	0.00	0.00	0.00	DR2ANA	.
DR3CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP3S	1000.0	0.00	0.00	0.00	0.00	DR3ANA	.
DR4CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP4S	1000.0	0.00	0.00	0.00	0.00	DR4ANA	.
DR5CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP5S	1000.0	0.00	0.00	0.00	0.00	DR5ANA	.
DR6CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP6S	1000.0	0.00	0.00	0.00	0.00	DR6ANA	.
HV7CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV7S2	100.00	HV7S3	1000.0	0.00	0.00	HV7ANA	.
HV8CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV8S2	100.00	HV8S3	1000.0	0.00	0.00	HV8ANA	.
HV9CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV9S2	100.00	HV9S3	1000.0	0.00	0.00	HV9ANA	.
HV10CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV10S2	100.00	HV10S3	1000.0	0.00	0.00	HV10ANA	.
HV11CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV11S2	100.00	HV11S3	1000.0	0.00	0.00	HV11ANA	.
HV12CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV12S2	100.00	HV12S3	1000.0	0.00	0.00	HV12ANA	.
DR7CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP7S	1000.0	0.00	0.00	0.00	0.00	DR7ANA	.
DR8CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP8S	1000.0	0.00	0.00	0.00	0.00	DR8ANA	.
DR9CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP9S	1000.0	0.00	0.00	0.00	0.00	DR9ANA	.
DR10CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP10S	1000.0	0.00	0.00	0.00	0.00	DR10ANA	.
DR11CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP11S	1000.0	0.00	0.00	0.00	0.00	DR11ANA	.
DR12CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP12S	1000.0	0.00	0.00	0.00	0.00	DR12ANA	.

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BL -- BOOLEAN BLOCK

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TAG	CT_CLO	OT_OP	ST_SC	IS_I	OUTPUT EQUAL	A_INPUT	B_INPUT	C_INPUT	D_INPUT	E_INPUT	F_INPUT	G_	H_	DESC	CP_COPY TO
PSBL1	CLOSE	OPEN	2	ON	(((((A+B)+C)+D)+E)+F)	PSON1	PSON2	PSON3	PSON4	PSON5	PSON6	0	0	Power Supplies on logic	PSAUTO1
PSBL2	CLOSE	OPEN	2	ON	(((((A+B)+C)+D)+E)+F)	PSON7	PSON8	PSON9	PSON10	PSON11	PSON12	0	0	Power Supplies on logic	PSAUTO2
PSFI1	CLOSE	OPEN	2:1	ON	(((((A*B)*C)*D)*E)*F)	CHR1A	CHR2A	CHR3A	CHR4A	CHRS1	CHRS2	0	0	Water Flow Interlock: PS1A-4A	PSIW1
PSFI2	CLOSE	OPEN	2:1	ON	(((((A*B)*C)*D)*E)*F)	CHR1B	CHR2B	CHR3B	CHR4B	CHRS1	CHRS2	0	0	Water Flow Interlock: PS1B-4B	PSIW2
PSFI3	CLOSE	OPEN	2	ON	(((((A*B)*C)*D)*E)*F)	MAG5A	MAG6A	MAG5B	MAG6B	MAGS1	MAGS2	0	0	Water Flow Interlocks: PS5 & 6	PSIW3
PSFI4	CLOSE	OPEN	2	ON	(((((A*B)*C)*D)*E)*F)	MAG7A	MAG8A	MAG7B	MAG8B	MAGS1	MAGS2	0	0	Water Flow Interlocks: PS7 & 8	PSIW4
PSFI5	CLOSE	OPEN	2:1	ON	(((((A*B)*C)*D)*E)*F)	CAR9A	CAR10A	CAR11A	CAR12A	CARS1	CARS2	0	0	Water Flow Interlocks: PS9A-12A	PSIW5
PSFI6	CLOSE	OPEN	2	ON	(((((A*B)*C)*D)*E)*F)	CAR9B	CAR10B	CAR11B	CAR12B	CARS1	CARS2	0	0	Water Flow Interlocks: PS9B-12B	PSIW6
PSXI1	CLOSE	OPEN	2	ON	(A*B)	CC5	CC6	0	0	0	0	0	0	Cover Interlocks - Chrome	PSIX1
PSXI2	CLOSE	OPEN	2:1	ON	(A*B)	CC5	CC6	0	0	0	0	0	0	Cover Interlocks - Chrome	PSIX2
PSXI3	CLOSE	OPEN	2	ON	(A*B)	CC9	CC10	0	0	0	0	0	0	Cover Interlocks - Mag	PSIX3
PSXI4	CLOSE	OPEN	2:1	ON	(A*B)	CC9	CC10	0	0	0	0	0	0	Cover Interlocks - Mag	PSIX4
PSXI5	CLOSE	OPEN	2	ON	(A*B)	CC11	CC12	0	0	0	0	0	0	Cover Interlocks - Carbon	PSIX5
PSXI6	CLOSE	OPEN	2:1	ON	(A*B)	CC11	CC12	0	0	0	0	0	0	Cover Interlocks - Carbon	PSIX6
14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

PG--PROGRAM BLOCK

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
COMPG	TH	L	1	ON	AUTO	AB/Fix Communications Detect	00	MAXWAIT	10		
							01	OPEN	CONTIN		
							02	WAITFOR	CONTIN	= CLOSE	
							03	CLOSE	CONTIN		
							04	NUL			
							05	NUL			
							06	NUL			
							07	NUL			
							08	NUL			
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
CTRSTPG	TH	L	5	ON	AUTO	Pallet counter reset program	00	MAXWAIT	6		
							01	IF	CTRST	= OPEN	GOTO 4
							02	WAITFOR	CTRST	= OPEN	
							03	OPEN	CTRST		
							04	GOTO	0		
							05	NUL			
							06	NUL			
							07	NUL			
							08	NUL			
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
GASPG1	TH	L	2:1		OFF	AUTO Gas Control Heater 1	00	SETLIM	10.00		
							01	IF	GF1	= OPEN	GOTO 5
							02	NUL			
							03	SETOUT	FLOST1	FLOSP1	
							04	GOTO	6		
							05	SETOUT	FLOST1	0	
							06	IF	GF2	= OPEN	GOTO 10
							07	NUL			
							08	SETOUT	FLOST2	FLOSP2	
							09	GOTO	0		
							10	SETOUT	FLOST2	0	
							11	GOTO	0		
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
GASPG2	TH	L	2		OFF	AUTO Gas Control Chrome	00	SETLIM	10.00		
							01	IF	GF3	= OPEN	GOTO 5
							02	NUL			
							03	SETOUT	FLOST3	FLOSP3	
							04	GOTO	6		
							05	SETOUT	FLOST3	0	
							06	IF	GF4	= OPEN	GOTO 10
							07	NUL			
							08	SETOUT	FLOST4	FLOSP4	
							09	GOTO	0		
							10	SETOUT	FLOSP4	0	
							11	GOTO	0		
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM					
GASPG3	TH	L	2:1	OFF	AUTO	Gas Control Mag	00	SETLIM	10.00			
							01	IF	GF5	= OPEN	GOTO	5
							02	NUL				
							03	SETOUT	FLOST5	FLOSP5		
							04	GOTO	6			
							05	SETOUT	FLOST5	0		
							06	IF	GF6	= OPEN	GOTO	10
							07	NUL				
							08	SETOUT	FLOST6	FLOSP6		
							09	GOTO	0			
							10	SETOUT	FLOST6	0		
							11	GOTO	0			
							12	NUL				
							13	NUL				
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				
GASPG4	TH	L	2	OFF	AUTO	Gas Control Carbon	00	SETLIM	10.00			
							01	IF	GF7	= OPEN	GOTO	5
							02	NUL				
							03	SETOUT	FLOST7	FLOSP7		
							04	GOTO	6			
							05	SETOUT	FLOST7	0		
							06	IF	GF8	= OPEN	GOTO	10
							07	NUL				
							08	SETOUT	FLOST8	FLOSP8		
							09	GOTO	0			
							10	SETOUT	FLOSP8	0		
							11	GOTO	0			
							12	NUL				
							13	NUL				
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
HTALPG	TH	L	2		ON	AUTO Heater Alarm Program	00	SETLIM		2.00	
							01	MAXWAIT	20		
							02	IF	RH1A	= OFF	GOTO 6
							03	WAITFOR	RH1A	= OFF	
							04	IF	HVO1	<	10.0 GOTO 18
							05	IF	HVO2	<	10.0 GOTO 18
							06	IF	RH2A	= OFF	GOTO 11
							07	WAITFOR	RH2A	= OFF	
							08	IF	HVO3	<	10.0 GOTO 18
							09	IF	HVO4	<	10.0 GOTO 18
							10	IF	HVO5	<	10.0 GOTO 18
							11	IF	RH3A	= OFF	GOTO 16
							12	WAITFOR	RH3A	= OFF	
							13	IF	HVO6	<	10.0 GOTO 18
							14	IF	HVO7	<	10.0 GOTO 18
							15	IF	HVO8	<	10.0 GOTO 18
							16	OPEN	HTALM		
							17	GOTO	0		
							18	CLOSE	HTALM		
							19	GOTO	0		
PGRUN	TH	L	30		ON	AUTO Run Flow and Pressure Blocks	00	IF	AUTO1	!= Off	GOTO 9
							01	IF	AUTO2	!= Off	GOTO 9
							02	STOP	CM2		
							03	STOP	CM3		
							04	STOP	CM4		
							05	STOP	FLO3		
							06	STOP	FLO5		
							07	STOP	FLO7		
							08	GOTO	0		
							09	RUN	CM2		
							10	RUN	CM3		
							11	RUN	CM4		
							12	RUN	FLO3		
							13	RUN	FLO5		
							14	RUN	FLO7		
							15	GOTO	0		
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSALPG1	TH	L	3		ON	AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON1	= Off	GOTO 6
							03	WAITFOR	PSSR1A	= OPEN	
							04	IF	PSSR1A	= CLOSE	GOTO 12
							05	IF	PSSR1B	= CLOSE	GOTO 12
							06	IF	PSON2	= Off	GOTO 10
							07	WAITFOR	PSSR2A	= OPEN	
							08	IF	PSSR2A	= CLOSE	GOTO 12
							09	IF	PSSR2B	= CLOSE	GOTO 12
							10	OPEN	CHRAL1		
							11	GOTO	0		
							12	CLOSE	CHRAL1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG10	TH	L	3		ON	AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON3	= Off	GOTO 6
							03	WAITFOR	PSARC3A	= OPEN	
							04	IF	PSARC3A	= OPEN	GOTO 12
							05	IF	PSARC3B	= OPEN	GOTO 12
							06	IF	PSON4	= Off	GOTO 10
							07	WAITFOR	PSARC4A	= OPEN	
							08	IF	PSARC4A	= OPEN	GOTO 12
							09	IF	PSARC4B	= OPEN	GOTO 12
							10	OPEN	CHARC2		
							11	GOTO	0		
							12	CLOSE	CHARC2		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSALPG11	TH	L	3:1	ON	AUTO	Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON7	= Off	GOTO 6
							03	WAITFOR	PSARC7A	= OPEN	
							04	IF	PSARC7A	= OPEN	GOTO 12
							05	IF	PSARC7B	= OPEN	GOTO 12
							06	IF	PSON8	= Off	GOTO 10
							07	WAITFOR	PSARC8A	= OPEN	
							08	IF	PSARC8A	= OPEN	GOTO 12
							09	IF	PSARC8B	= OPEN	GOTO 12
							10	OPEN	MGARC2		
							11	GOTO	0		
							12	CLOSE	MGARC2		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG12	TH	L	3:2	ON	AUTO	Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON11	= Off	GOTO 6
							03	WAITFOR	PSARC11A	= OPEN	
							04	IF	PSARC11A	= OPEN	GOTO 12
							05	IF	PSARC11B	= OPEN	GOTO 12
							06	IF	PSON12	= Off	GOTO 10
							07	WAITFOR	PSARC20	= OPEN	
							08	IF	PSARC20	= OPEN	GOTO 12
							09	NUL			
							10	OPEN	CAARC2		
							11	GOTO	0		
							12	CLOSE	CAARC2		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG       AD_ AP ST_SCA IS_IN IA_I DESC                                       PROGRAM
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PSALPG2   TH  L  3:1    ON    AUTO Power Supply Setpoint Alarm            00  MAXWAIT   20
                                                                          01  NUL
                                                                          02  IF        PSON5     = Off    GOTO 6
                                                                          03  WAITFOR   PSSR5A    = OPEN
                                                                          04  IF        PSSR5A    = CLOSE GOTO 12
                                                                          05  IF        PSSR5B    = CLOSE GOTO 12
                                                                          06  IF        PSON6     = Off    GOTO 10
                                                                          07  WAITFOR   PSSR6A    = OPEN
                                                                          08  IF        PSSR6A    = CLOSE GOTO 12
                                                                          09  IF        PSSR6B    = CLOSE GOTO 12
                                                                          10  OPEN      MAGAL1
                                                                          11  GOTO      0
                                                                          12  CLOSE     MAGAL1
                                                                          13  GOTO      0
                                                                          14  NUL
                                                                          15  NUL
                                                                          16  NUL
                                                                          17  NUL
                                                                          18  NUL
                                                                          19  NUL

PSALPG3   TH  L  3:2    ON    AUTO Power Supply Setpoint Alarm            00  MAXWAIT   20
                                                                          01  NUL
                                                                          02  IF        PSON9     = Off    GOTO 6
                                                                          03  WAITFOR   PSSR9A    = OPEN
                                                                          04  IF        PSSR9A    = CLOSE GOTO 12
                                                                          05  IF        PSSR9B    = CLOSE GOTO 12
                                                                          06  IF        PSON10    = Off    GOTO 10
                                                                          07  WAITFOR   PSSR10A   = OPEN
                                                                          08  IF        PSSR10A   = CLOSE GOTO 12
                                                                          09  IF        PSSR10B   = CLOSE GOTO 12
                                                                          10  OPEN      CARAL1
                                                                          11  GOTO      0
                                                                          12  CLOSE     CARAL1
                                                                          13  GOTO      0
                                                                          14  NUL
                                                                          15  NUL
                                                                          16  NUL
                                                                          17  NUL
                                                                          18  NUL
                                                                          19  NUL
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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSALPG4	TH	L	3	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON3	= Off	GOTO 6
							03	WAITFOR	PSSR3A	= OPEN	
							04	IF	PSSR3A	= CLOSE	GOTO 12
							05	IF	PSSR3B	= CLOSE	GOTO 12
							06	IF	PSON4	= Off	GOTO 10
							07	WAITFOR	PSSR4A	= OPEN	
							08	IF	PSSR4A	= CLOSE	GOTO 12
							09	IF	PSSR4B	= CLOSE	GOTO 12
							10	OPEN	CHRAL2		
							11	GOTO	0		
							12	CLOSE	CHRAL2		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG5	TH	L	3:1	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON7	= Off	GOTO 6
							03	WAITFOR	PSSR7A	= OPEN	
							04	IF	PSSR7A	= CLOSE	GOTO 12
							05	IF	PSSR7B	= CLOSE	GOTO 12
							06	IF	PSON8	= Off	GOTO 10
							07	WAITFOR	PSSR8A	= OPEN	
							08	IF	PSSR8A	= CLOSE	GOTO 12
							09	IF	PSSR8B	= CLOSE	GOTO 12
							10	OPEN	MAGAL2		
							11	GOTO	0		
							12	CLOSE	MAGAL2		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM					
PSALPG6	TH	L	3:2	ON	AUTO	Power Supply Setpoint Alarm	00	MAXWAIT	20			
							01	NUL				
							02	IF	PSON11	= Off	GOTO	6
							03	WAITFOR	PSSR11A	= OPEN		
							04	IF	PSSR11A	= CLOSE	GOTO	12
							05	IF	PSSR11B	= CLOSE	GOTO	12
							06	IF	PSON12	= Off	GOTO	10
							07	WAITFOR	PSSR12A	= OPEN		
							08	IF	PSSR12A	= CLOSE	GOTO	12
							09	IF	PSSR12B	= CLOSE	GOTO	12
							10	OPEN	CARAL2			
							11	GOTO	0			
							12	CLOSE	CARAL2			
							13	GOTO	0			
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				
PSALPG7	TH	L	3	ON	AUTO	Power Supply Setpoint Alarm	00	MAXWAIT	20			
							01	NUL				
							02	IF	PSON1	= Off	GOTO	6
							03	WAITFOR	PSARC1A	= OPEN		
							04	IF	PSARC1A	= OPEN	GOTO	12
							05	IF	PSARC1B	= OPEN	GOTO	12
							06	IF	PSON2	= Off	GOTO	10
							07	WAITFOR	PSARC2A	= OPEN		
							08	IF	PSARC2A	= OPEN	GOTO	12
							09	IF	PSARC2B	= OPEN	GOTO	12
							10	OPEN	CHARC1			
							11	GOTO	0			
							12	CLOSE	CHARC1			
							13	GOTO	0			
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSALPG8	TH	L	3:1	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON5	= Off	GOTO 6
							03	WAITFOR	PSARC5A	= OPEN	
							04	IF	PSARC5A	= OPEN	GOTO 12
							05	IF	PSARC5B	= OPEN	GOTO 12
							06	IF	PSON6	= Off	GOTO 10
							07	WAITFOR	PSARC6A	= OPEN	
							08	IF	PSARC6A	= OPEN	GOTO 12
							09	IF	PSARC6B	= OPEN	GOTO 12
							10	OPEN	MGARC1		
							11	GOTO	0		
							12	CLOSE	MGARC1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG9	TH	L	3:2	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON9	= Off	GOTO 6
							03	WAITFOR	PSARC9A	= OPEN	
							04	IF	PSARC9A	= OPEN	GOTO 12
							05	NUL			
							06	IF	PSON10	= Off	GOTO 10
							07	WAITFOR	PSARC10A	= OPEN	
							08	IF	PSARC10A	= OPEN	GOTO 12
							09	IF	PSARC10B	= OPEN	GOTO 12
							10	OPEN	CAARC1		
							11	GOTO	0		
							12	CLOSE	CAARC1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

```
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TAG      AD_ AP ST_SCA IS_IN IA_I DESC                                         PROGRAM
-------  --- -- ------ ----- ---- ---------------------------------------- ---------------------------------------------
PSFPG1   TH  L  6      ON    AUTO Change PFS Value                          00  1    != Off    GOTO 3
                                                                            01  SETOUT    PSF1         1
                                                                            02  GOTO      4
                                                                            03  SETOUT    PSF1         2
                                                                            04  2    != Off    GOTO 7
                                                                            05  SETOUT    PSF2         1
                                                                            06  GOTO      8
                                                                            07  SETOUT    PSF2         2
                                                                            08  3    != Off    GOTO 11
                                                                            09  SETOUT    PSF3         1
                                                                            10  GOTO      12
                                                                            11  SETOUT    PSF3         2
                                                                            12  4    != Off    GOTO 15
                                                                            13  SETOUT    PSF4         1
                                                                            14  GOTO      0
                                                                            15  SETOUT    PSF4         2
                                                                            16  GOTO      0
                                                                            17  NUL
                                                                            18  NUL
                                                                            19  NUL

PSFPG2   TH  L  6:2    ON    AUTO Change PFS Value                          00  5    != Off    GOTO 3
                                                                            01  SETOUT    PSF5         1
                                                                            02  GOTO      4
                                                                            03  SETOUT    PSF5         2
                                                                            04  6    != Off    GOTO 7
                                                                            05  SETOUT    PSF6         1
                                                                            06  GOTO      8
                                                                            07  SETOUT    PSF6         2
                                                                            08  7    != Off    GOTO 11
                                                                            09  SETOUT    PSF7         1
                                                                            10  GOTO      12
                                                                            11  SETOUT    PSF7         2
                                                                            12  8    != Off    GOTO 15
                                                                            13  SETOUT    PSF8         1
                                                                            14  GOTO      0
                                                                            15  SETOUT    PSF8         2
                                                                            16  GOTO      0
                                                                            17  NUL
                                                                            18  NUL
                                                                            19  NUL
```

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM
PSFPG3	TH	L	6:4	ON	AUTO	Change PFS Value	00 9 != Off GOTO 3
							01 SETOUT PSF9 1
							02 GOTO 4
							03 SETOUT PSF9 2
							04 10 != Off GOTO 7
							05 SETOUT PSF10 1
							06 GOTO 8
							07 SETOUT PSF10 2
							08 11 != Off GOTO 11
							09 SETOUT PSF11 1
							10 GOTO 12
							11 SETOUT PSF11 2
							12 12 != Off GOTO 15
							13 SETOUT PSF12 1
							14 GOTO 0
							15 SETOUT PSF12 2
							16 GOTO 0
							17 NUL
							18 NUL
							19 NUL
PSVI1	TH	L	3	ON	AUTO	Power Supply Vacuum Interlock - Chrome	00 IF TC6 = OPEN GOTO 5
							01 IF PSIV1 = CLOSE GOTO 0
							02 CLOSE PSIV1
							03 CLOSE PSIV2
							04 GOTO 0
							05 IF PSIV1 = OPEN GOTO 0
							06 OPEN PSIV1
							07 OPEN PSIV2
							08 GOTO 0
							09 NUL
							10 NUL
							11 NUL
							12 NUL
							13 NUL
							14 NUL
							15 NUL
							16 NUL
							17 NUL
							18 NUL
							19 NUL

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSVI2	TH	L	3:1	ON	AUTO	Power Supply Vacuum Interlock - Mag	00	IF	TC11	= OPEN	GOTO 5
							01	IF	PSIV3	= CLOSE	GOTO 0
							02	CLOSE	PSIV3		
							03	CLOSE	PSIV4		
							04	GOTO	0		
							05	IF	PSIV3	= OPEN	GOTO 0
							06	OPEN	PSIV3		
							07	OPEN	PSIV4		
							08	GOTO	0		
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSVI3	TH	L	3:2	ON	AUTO	Power Supply Vacuum Interlock - Carbon	00	IF	TC16	= OPEN	GOTO 5
							01	IF	PSIV5	= CLOSE	GOTO 0
							02	CLOSE	PSIV5		
							03	CLOSE	PSIV6		
							04	GOTO	0		
							05	IF	PSIV5	= OPEN	GOTO 0
							06	OPEN	PSIV5		
							07	OPEN	PSIV6		
							08	GOTO	0		
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
RCPPG	TH	L	3		ON	AUTO Select Recipe to Load	00	IF	SELRCP1	!=	CLOSE GOTO 2
							01	SETOUT	RCPREG		1
							02	IF	SELRCP2	!=	CLOSE GOTO 4
							03	SETOUT	RCPREG		2
							04	IF	SELRCP3	!=	CLOSE GOTO 6
							05	SETOUT	RCPREG		3
							06	IF	SELRCP4	!=	CLOSE GOTO 0
							07	SETOUT	RCPREG		4
							08	GOTO	0		
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
TD1PROG	TH	L	3:1		ON	AUTO Cryo #1 Temperature Select	00	IF	TD1	<=	2.22 GOTO 4
							01	SETOUT	85		
							02	SETOUT	63		
							03	GOTO	6		
							04	SETOUT	58		
							05	SETOUT	00		
							06	IF	TD2	<=	2.22 GOTO 10
							07	SETOUT	85		
							08	SETOUT	63		
							09	GOTO	12		
							10	SETOUT	58		
							11	SETOUT	00		
							12	IF	TD3	<=	2.22 GOTO 16
							13	SETOUT	85		
							14	SETOUT	63		
							15	GOTO	0		
							16	SETOUT	58		
							17	SETOUT	00		
							18	GOTO	0		
							19	NUL			

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TAG      AD_ AP ST_SCA IS_IN IA_I DESC                                        PROGRAM
-------  --- -- ------ ----- ---- ----------------------------------------  ---------------------------------------------
TD2PROG  TH  L  3:2    ON    AUTO Cryo #1 Temperature Select               00  IF      TD4    <=   2.22 GOTO 4
                                                                           01  SETOUT  85
                                                                           02  SETOUT  63
                                                                           03  GOTO     6
                                                                           04  SETOUT  58
                                                                           05  SETOUT  00
                                                                           06  IF      TD5    <=   2.22 GOTO 10
                                                                           07  SETOUT  85
                                                                           08  SETOUT  63
                                                                           09  GOTO    12
                                                                           10  SETOUT  58
                                                                           11  SETOUT  00
                                                                           12  IF      TD6    <=   2.22 GOTO 16
                                                                           13  SETOUT  85
                                                                           14  SETOUT  63
                                                                           15  GOTO     0
                                                                           16  SETOUT  58
                                                                           17  SETOUT  00
                                                                           18  GOTO     0
                                                                           19  NUL

TD3PROG  TH  L  3      ON    AUTO Cryo 3 Temperature Select                00  IF      TD7    <=   2.22 GOTO 4
                                                                           01  SETOUT  85
                                                                           02  SETOUT  63
                                                                           03  GOTO     6
                                                                           04  SETOUT  58
                                                                           05  SETOUT  00
                                                                           06  IF      TD8    <=   2.22 GOTO 10
                                                                           07  SETOUT  85
                                                                           08  SETOUT  63
                                                                           09  GOTO    12
                                                                           10  SETOUT  58
                                                                           11  SETOUT  00
                                                                           12  IF      TD9    <=   2.22 GOTO 16
                                                                           13  SETOUT  85
                                                                           14  SETOUT  63
                                                                           15  GOTO     0
                                                                           16  SETOUT  58
                                                                           17  SETOUT  00
                                                                           18  GOTO     0
                                                                           19  NUL
```

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC
TD4PROG	TH	L	3:1	ON		AUTO Cryo 4 Temperature Select

PROGRAM

00	IF	TD10	<=	2.22	GOTO 4
01	SETOUT	85			
02	SETOUT	63			
03	GOTO	6			
04	SETOUT	58			
05	SETOUT	00			
06	IF	TD11	<=	2.22	GOTO 10
07	SETOUT	58			
08	SETOUT	63			
09	GOTO	12			
10	SETOUT	58			
11	SETOUT	00			
12	IF	TD12	<=	2.22	GOTO 16
13	SETOUT	85			
14	SETOUT	63			
15	GOTO	0			
16	SETOUT	58			
17	SETOUT	00			
18	GOTO	0			
19	NUL				

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```
                                                                                  CY11TMP20   CY12TMP20   TEMP21
                                                                                      B3          B3          B3
------                                                                           ----] [---------] [--------( )--
GOTO 4                                                                               511         512          21
Rung #022
       |PALLET     PALLET      PALLET      PALLET      PALLET     PALLET      PALLET      PALLET      PALLET      PALLET      PALLET
       |DETECTED   DETECTED    DETECTED    DETECTED    DETECTED   DETECTED    DETECTED    DETECTED    DETECTED    DETECTED    DETECTED
       |LEFT SIDE  RIGHT SIDE  LEFT SIDE   LEFT SIDE   LEFT SIDE  LEFT SIDE   LEFT SIDE   LEFT SIDE   LEFT SIDE   LEFT SIDE   LEFT SIDE
       |ENTRANCE   ENTRANCE    HEATER 1    HEATER 2    DWELL 1    CHROME      DWELL 2     HEATER 3    DWELL 3     MAGNETIC    DWELL 4
GOTO 1 |SEN1       SEN3        SEN7        SEN10       SEN13      SEN16       SEN19       SEN22       SEN25       SEN28       SEN31
       |  I:003      I:003       I:003       I:003       I:003      I:023       I:023       I:023       I:023       I:037       I:037
       |---] [-------] [---------] [---------] [---------] [--------] [---------] [---------] [---------] [---------] [---------] [--
       |    00         02          06          11          14         00          03          06          11          00          03
                                                                              PALLET      PALLET      PALLET      PALLET
                                                                              DETECTED    DETECTED    DETECTED    DETECTED
GOTO 1                                                                        LEFT SIDE   LEFT SIDE   LEFT SIDE   LEFT SIDE
                                                                              BUFFER 3    DWELL 5     CARBON      DWELL 6      TEMP
                                                                              SEN34       SEN37       SEN40       SEN43        TEMP16
                                                                                I:037       I:037       I:053       I:053        B3
                                                                             ----] [---------] [---------] [---------] [--------( )--
                                                                                 06          11          00          03          16
       B3/16 - -( )- - File #6 TECH_RUNGS -  18
Rung #023
       |PALLET     PALLET      PALLET      PALLET      PALLET
       |DETECTED   DETECTED    DETECTED    DETECTED    DETECTED
       |LEFT SIDE  LEFT SIDE   LEFT SIDE   LEFT SIDE   RIGHT SIDE
       |BUFFER 4   EXBUFFER    EXIT LOCK   EXIT END    EXIT END
       |SEN46      SEN49       SEN52       SEN55       SEN57
       |  I:053      I:053       I:053       I:053       I:054                                                                B3
       |---] [-------] [---------] [---------] [---------] [-------------------------------------------------------------------( )--
       |    06         11          14          17          17                                                                 17
Rung #024
       |                                                                                                          RETURN FROM
       |                                                                                                          TECH RUNGS
       |                                                                                                          TO MAIN
       |                                                                                                          FROM_TR
       |                                                                                                          +--RET-------+
       |----------------------------------------------------------------------------------------------------------+RETURN ()   +--
       |                                                                                                          +------------+
Rung #025
       |-------------------------------------------------------------------------------------------------------------------[END]--
```

The apparatus of the present invention provides a high-speed in-line sputtering apparatus for producing superior multilayer films on substrates, such as disks suitable for use in Winchester-type hard disk drives. The process of the present invention provides an improved method of providing multilayer coatings to a variety of substrate types at a much greater rate than prior art methods.

Also described herein are a novel means for heating substrates to be coated, a novel sputtering magnetron design, a novel, variable speed, overhead, non-contaminating substrate transportation system and a comprehensive, centralized, programmable electronic means for controlling the apparatus and process are provided. Still further, when the process and apparatus are used for providing magnetic coatings for substrates, such as disks, to be utilized in hard disk drives using Winchester-type technology, a unique disk texturing method for improving the disk's magnetic recording properties, and a novel disk carrier (or pallet) design which contributes to uniform substrate heating characteristics in a large, single, high capacity pallet, are also provided herein. Numerous variations are possible as will be apparent to those skilled in the art; such variations are intended to be within the scope of the invention as defined by this specification and the following claims are intended to cover all the modifications and equivalents falling within the scope of the invention.

CLAIMS

What is claimed is:

1. A high throughput sputtering apparatus for providing a single or multi-layer coating to the surface of a plurality of substrates, said apparatus including a plurality of buffer and sputtering chambers, and an input end and an output end, wherein said substrates are transported through said chambers of said apparatus at varying rates of speed such that the rate of speed of a pallet from said input end to said output end is a constant for each of said plurality of pallets.

2. A high throughput sputtering apparatus having a plurality of integrally matched components, said components comprising:

means for sputtering a multi-layer coating onto a plurality of substrates, said means for sputtering including a series of sputtering chambers each having relative isolation from adjacent chambers to reduce cross contamination between the coating components being sputtered onto substrates therein, said sputtering chambers being isolated from ambient atmospheric conditions;

means for transporting said plurality of substrates through said means for sputtering at variable velocities;

means for reducing the ambient pressure within said means for sputtering to a vacuum level within a pressure range sufficient to enable sputtering operation;

means for heating said plurality of substrates to a temperature conducive to sputtering said multi-layer coatings thereon, said means for heating providing a

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substantially uniform temperature profile over the surface of said substrate; and

control means for providing control signals to, and for receiving feedback input from, said means for sputtering, means for transporting, means for reducing and means for heating, said control means being programmable for allowing control over said means for sputtering, means for transporting, means for reducing and means for heating.

3. A high throughput sputtering apparatus, comprising:

control means for providing control signals and for monitoring a plurality of sensory input signals;

means for transporting a plurality of substrates through a sequential series of concurrent sputtering steps at selected variable velocities responsive to said control signals, said means including a first set of means for providing said sensory input signals to said control means;

means for reducing the ambient pressure within the apparatus to a common reduced pressure level within a pressure range to enable sputtering operation responsive to said control means, said means for reducing including a second set of means for providing said sensory input signals to said control means;

means for heating said plurality of substrates to an ambient temperature, said temperature having a substantially uniform profile over the surface of said substrate, said means for heating including a third set of means for providing said sensory input signals to said control means;

and

means for sputtering a multi-layer coating onto said substrate responsive to said control means, said means for sputtering including a third set of means for providing said sensory input signals to said control means.

4. A high throughput direct current magnetron sputtering process for producing multilayer thin films, comprising the steps of:

providing substrates to be sputtered;

creating an environment about said substrates, said environment having a pressure within a pressure range which would enable sputtering operations;

providing a gas into said environment in a plasma state and within said pressure range to carry out sputtering operations;

transporting substrates at varying velocities through said environment a sequence of sputtering steps within said environment and along a return path external to said environment, and simultaneously

introducing the substrates into said environment without substantially disrupting said pressure of said environment,

providing rapid and uniform heating of said substrates to optimize film integrity during sputtering steps, and

sputtering said substrates to provide successive layers of thin films on the substrates;

and

removing the sputtered substrates without contaminating said environment.

5. A high throughput direct current sputtering process for producing multilayer thin films on magnetic recording media, comprising the steps of:

providing substrates;

physically abrading the substrates to achieve a uniform texture of intersecting circumferential lines across the substrate surface;

cleaning said substrates;

providing a sputtering environment about said substrates, said environment having a pressure within a pressure range to enable sputtering operations;

loading the substrates into a high capacity carrier of sufficient dimensions to accommodate substrate and carrier thermal expansion and enhance thermal uniformity between individual substrates;

introducing the substrates into said environment without disrupting said environment;

transporting the substrates at varying velocities through said environment a return path external to said environment while protecting substrates from contamination;

providing a gas in a plasma state into said environment at a pressure sufficient to carry out sputtering operations;

providing rapid and uniform heating of the substrates to optimize film integrity during subsequent sputtering steps;

sputtering to provide successive layers of thin films on said substrates; and

removing the coated substrates without disrupting sputtering operations.

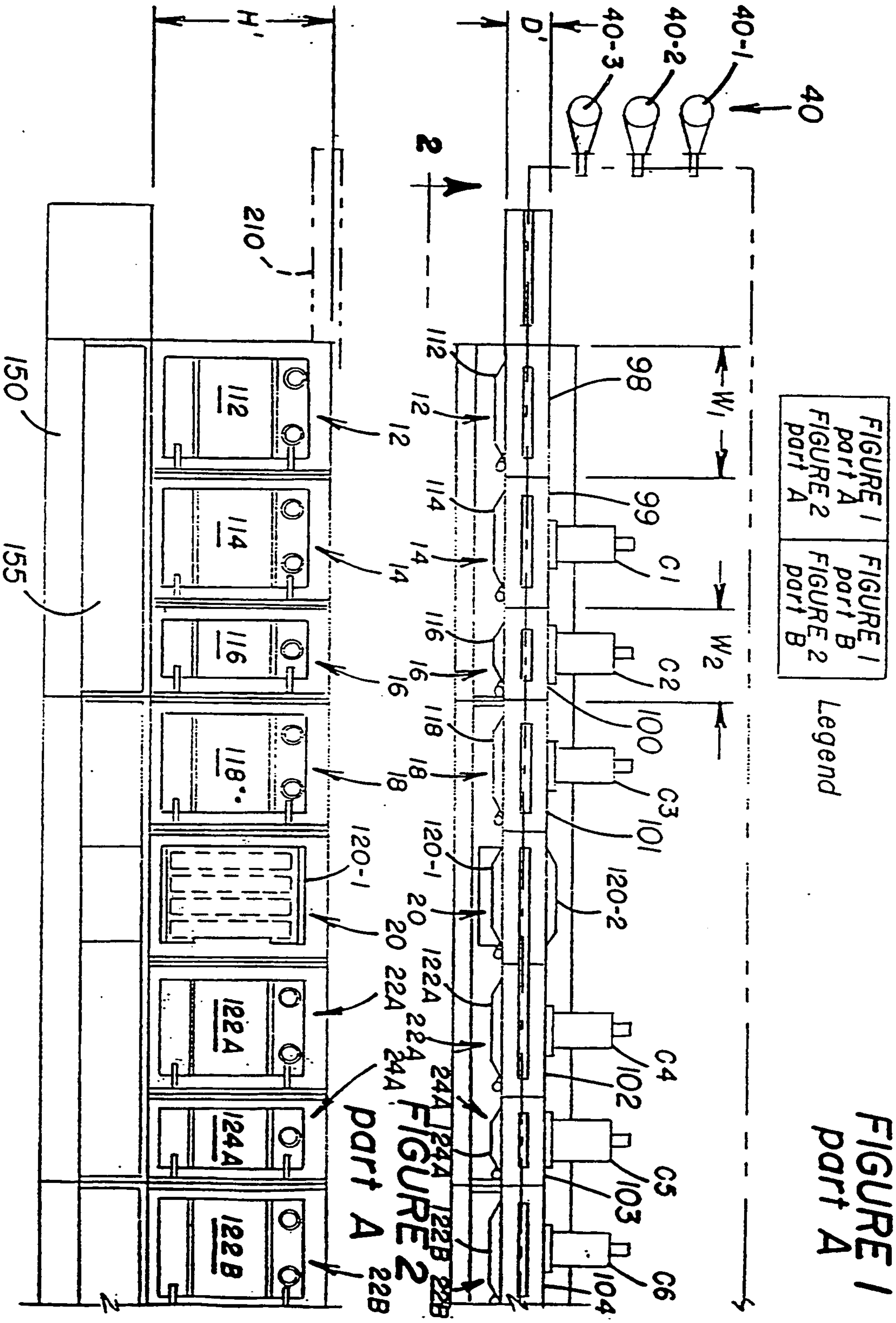


FIGURE 2 part A

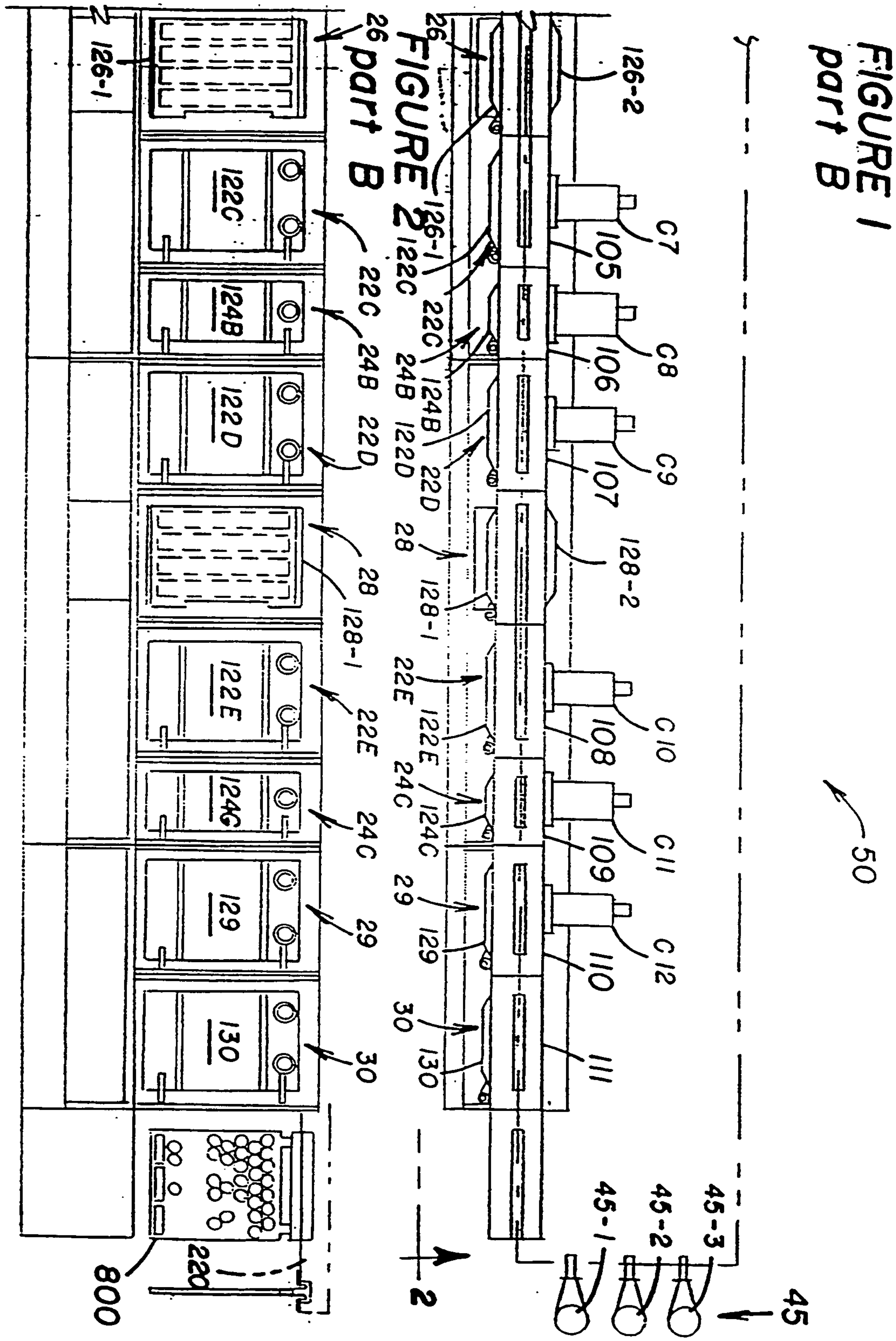


FIGURE 1
part B
FIGURE 2
part B
50
45
45-1
45-2
45-3
126-1
126-2
122C
124B
122D
128-1
128-2
122E
124C
129
130
22C
24B
22D
28
22E
24C
29
30
26
105
106
107
108
109
110
111
C7
C8
C9
C10
C11
C12
220
800
2

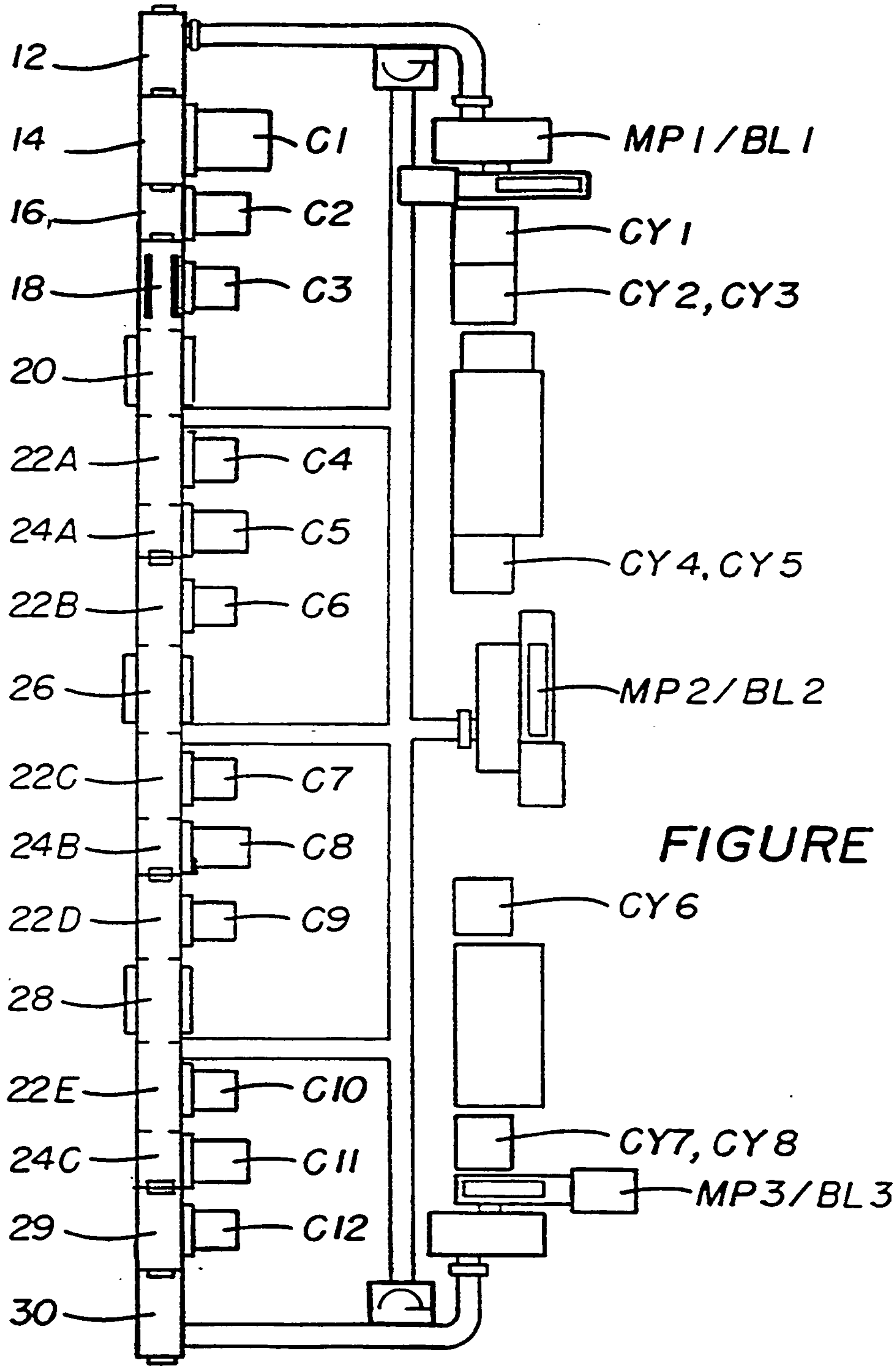

12
14
16
18
20
22A
24A
22B
26
22C
24B
22D
28
22E
24C
29
30
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
MP1/BL1
CY1
CY2, CY3
CY4, CY5
MP2/BL2
CY6
CY7, CY8
MP3/BL3

FIGURE 3

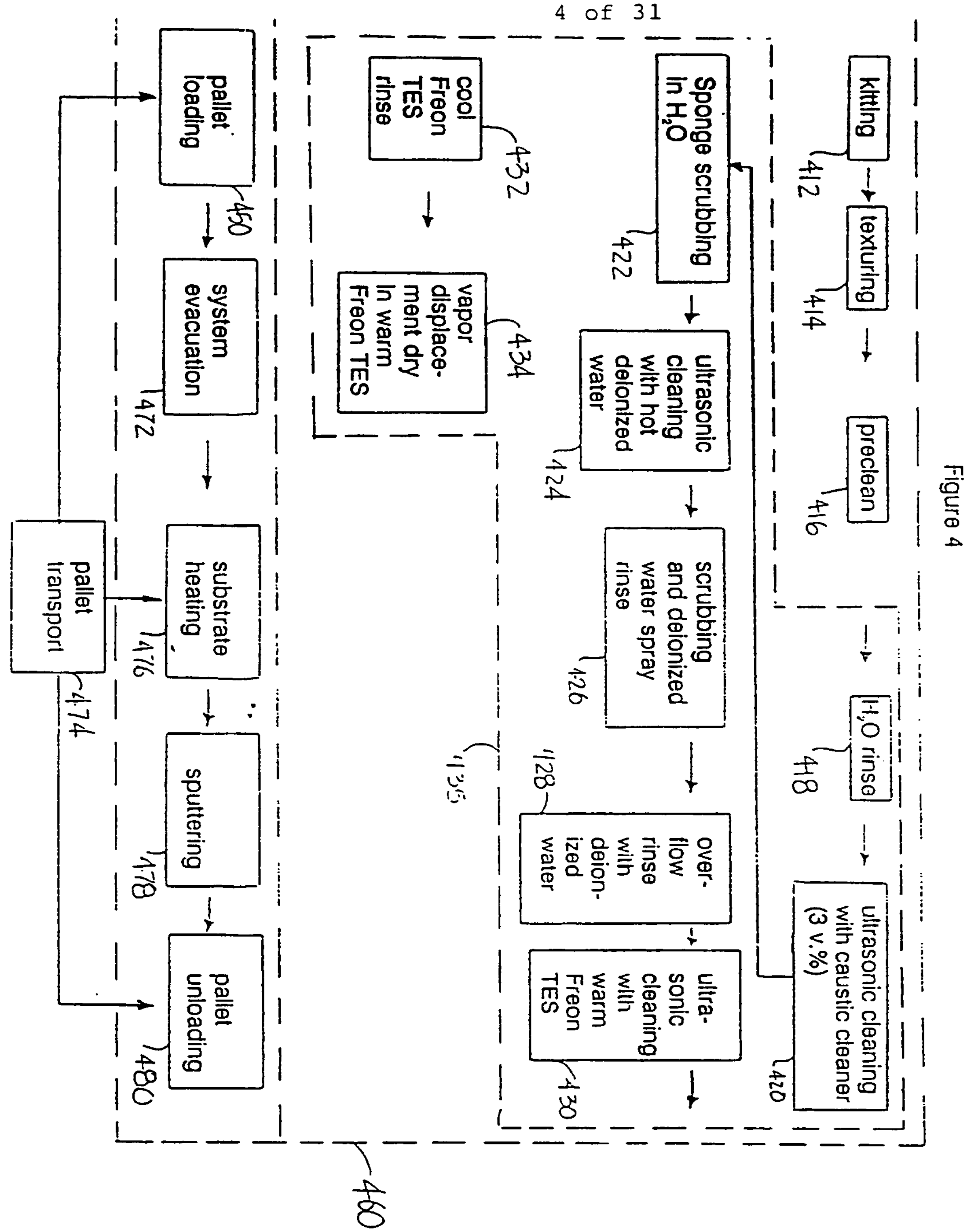

kitting
412
texturing
414
preclean
416
H2O rinse
418
ultrasonic cleaning with caustic cleaner (3 v.%)
420
Sponge scrubbing in H2O
422
ultrasonic cleaning with hot deionized water
424
scrubbing and deionized water spray rinse
426
over-flow rinse with deion-ized water
428
ultra-sonic cleaning with warm Freon TES
430
cool Freon TES rinse
432
vapor displace-ment dry in warm Freon TES
434
436
pallet loading
470
system evacuation
472
pallet transport
474
substrate heating
476
sputtering
478
pallet unloading
480
460

Figure 4

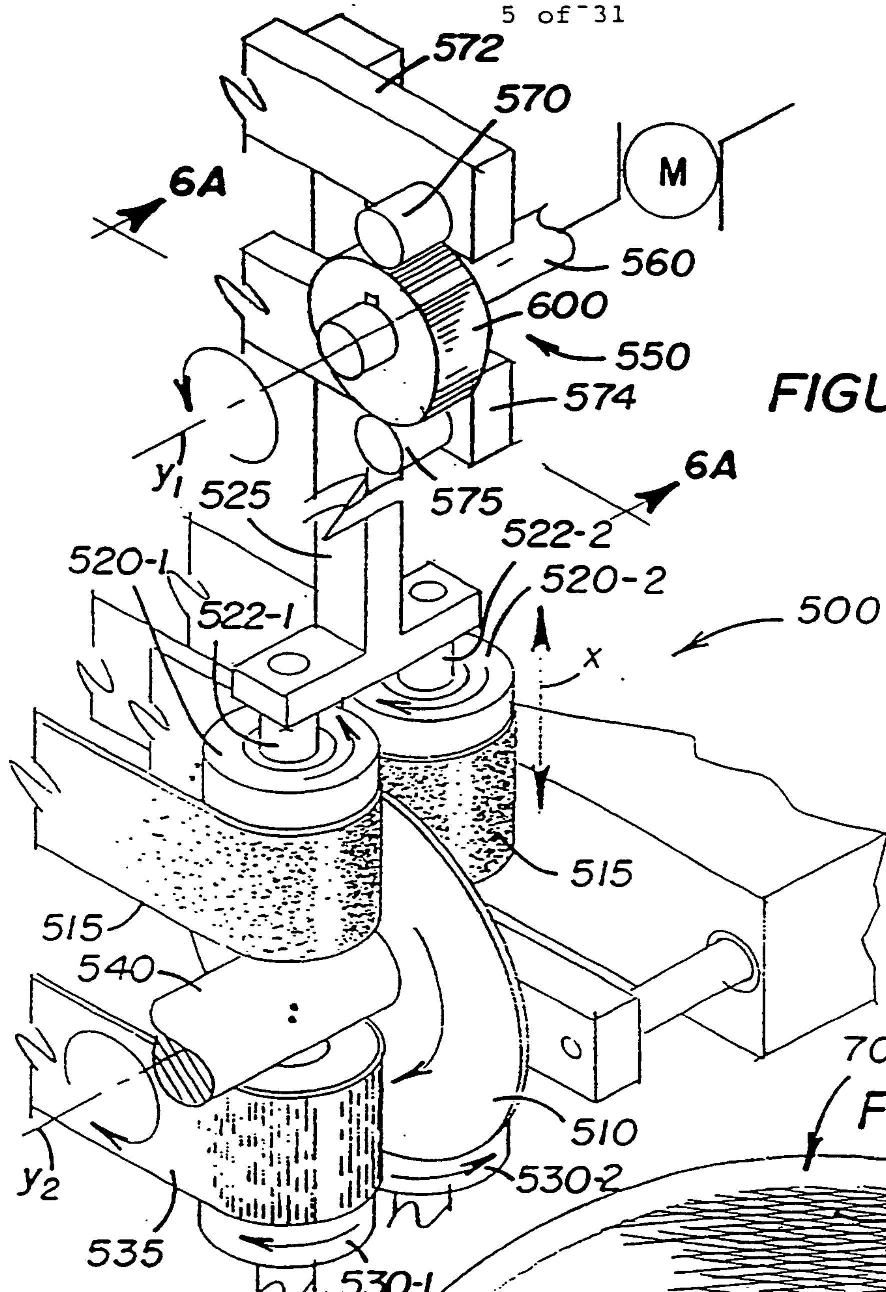
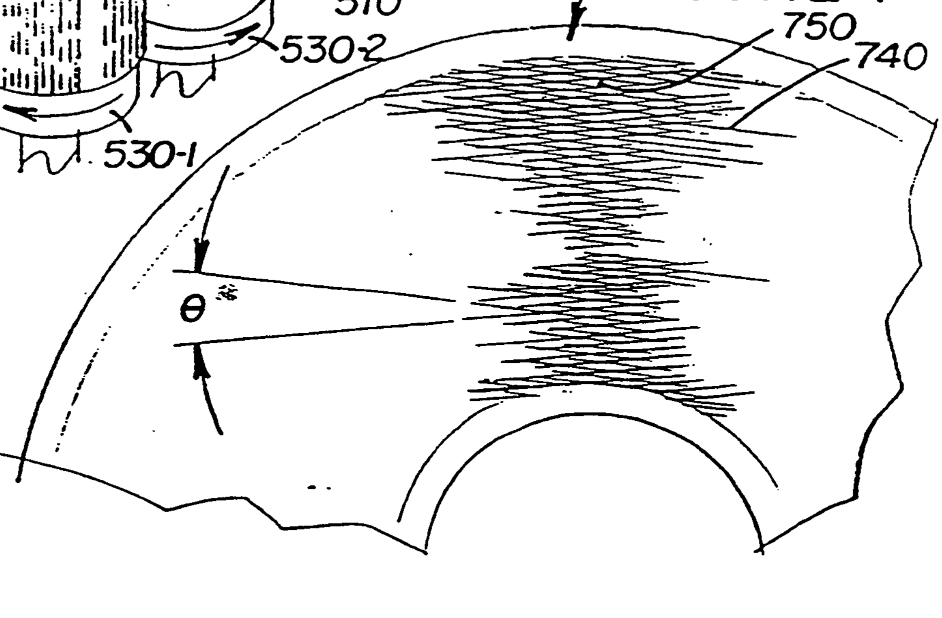


FIGURE 5

FIGURE 7



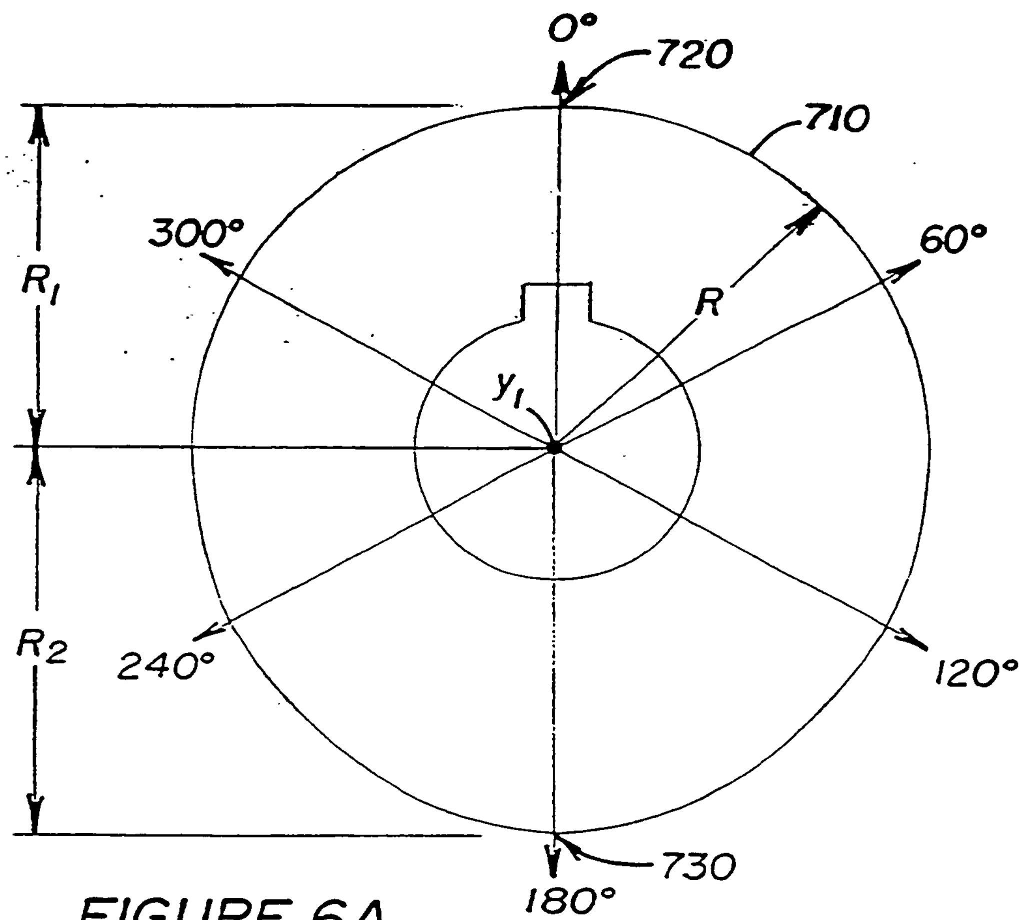


FIGURE 6A

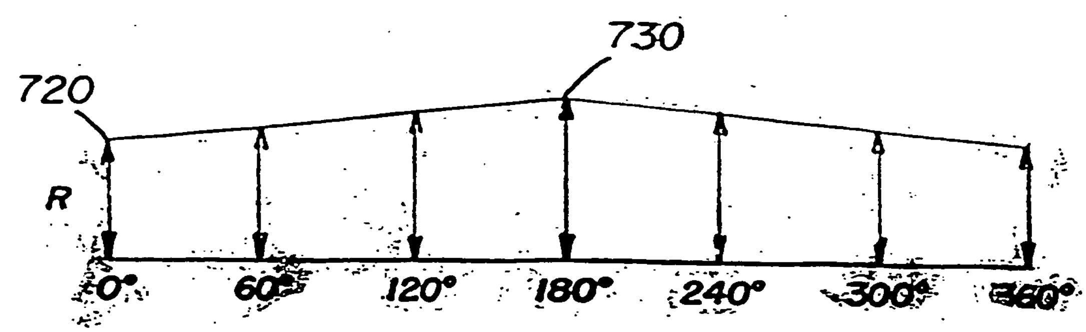


FIGURE 6B

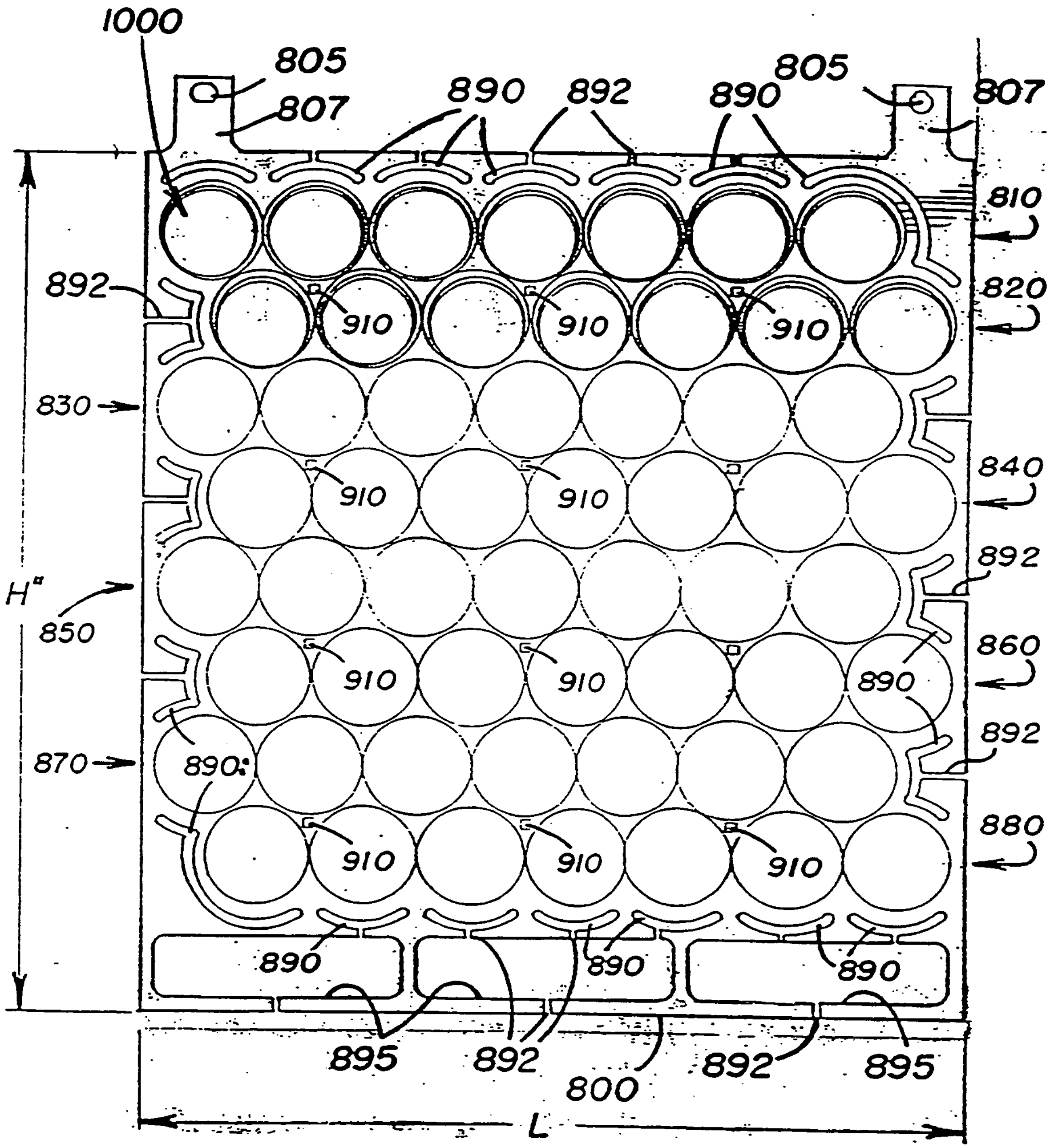

1000
805
807
890
892
890
805
807
810
892
910
910
910
820
830
840
910
910
892
H"
850
860
910
910
890
892
870
890
880
910
910
910
890
890
890
895
892
800
892
895
L

FIGURE 8

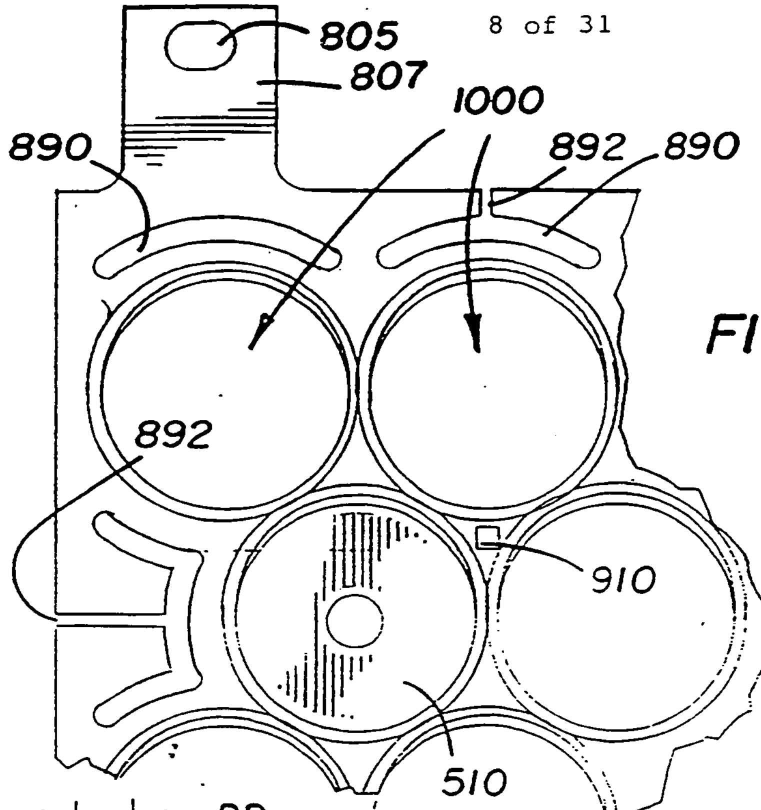


FIGURE 9

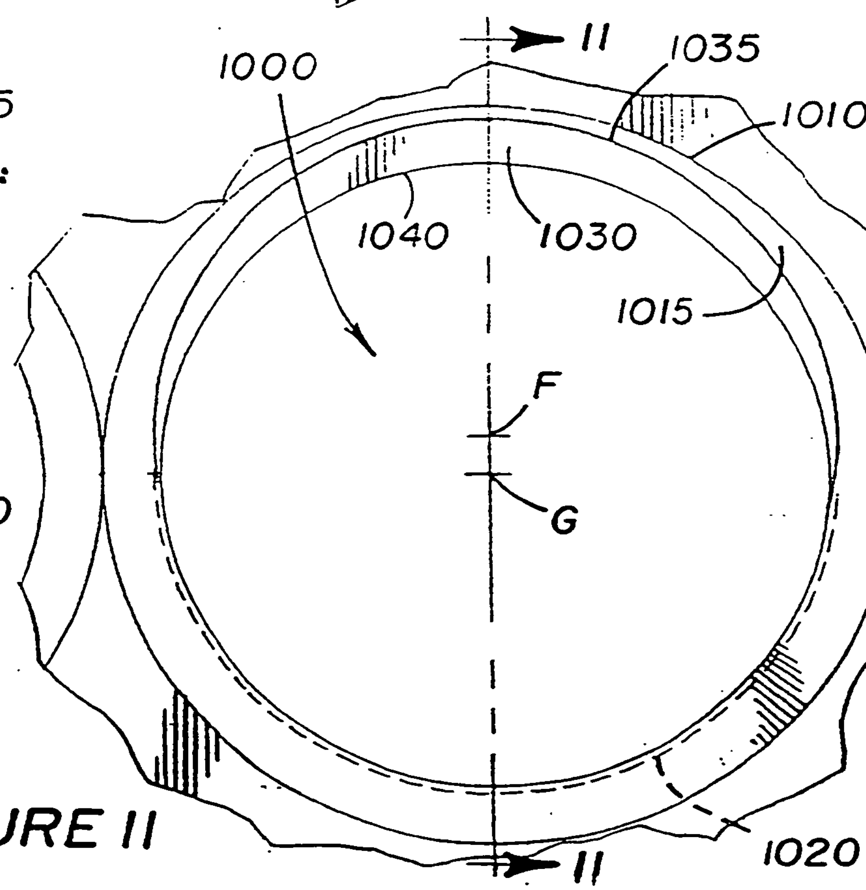


FIGURE 10

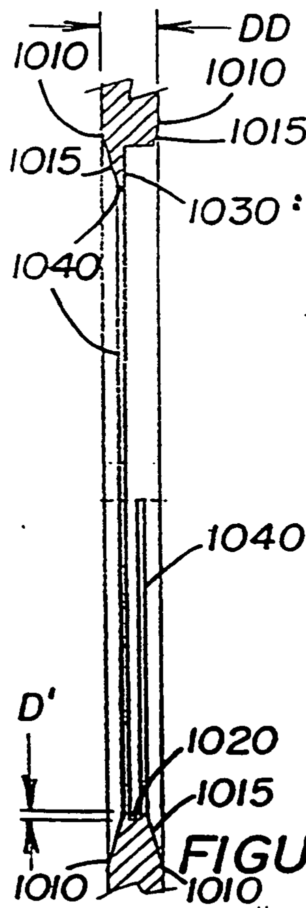


FIGURE 11

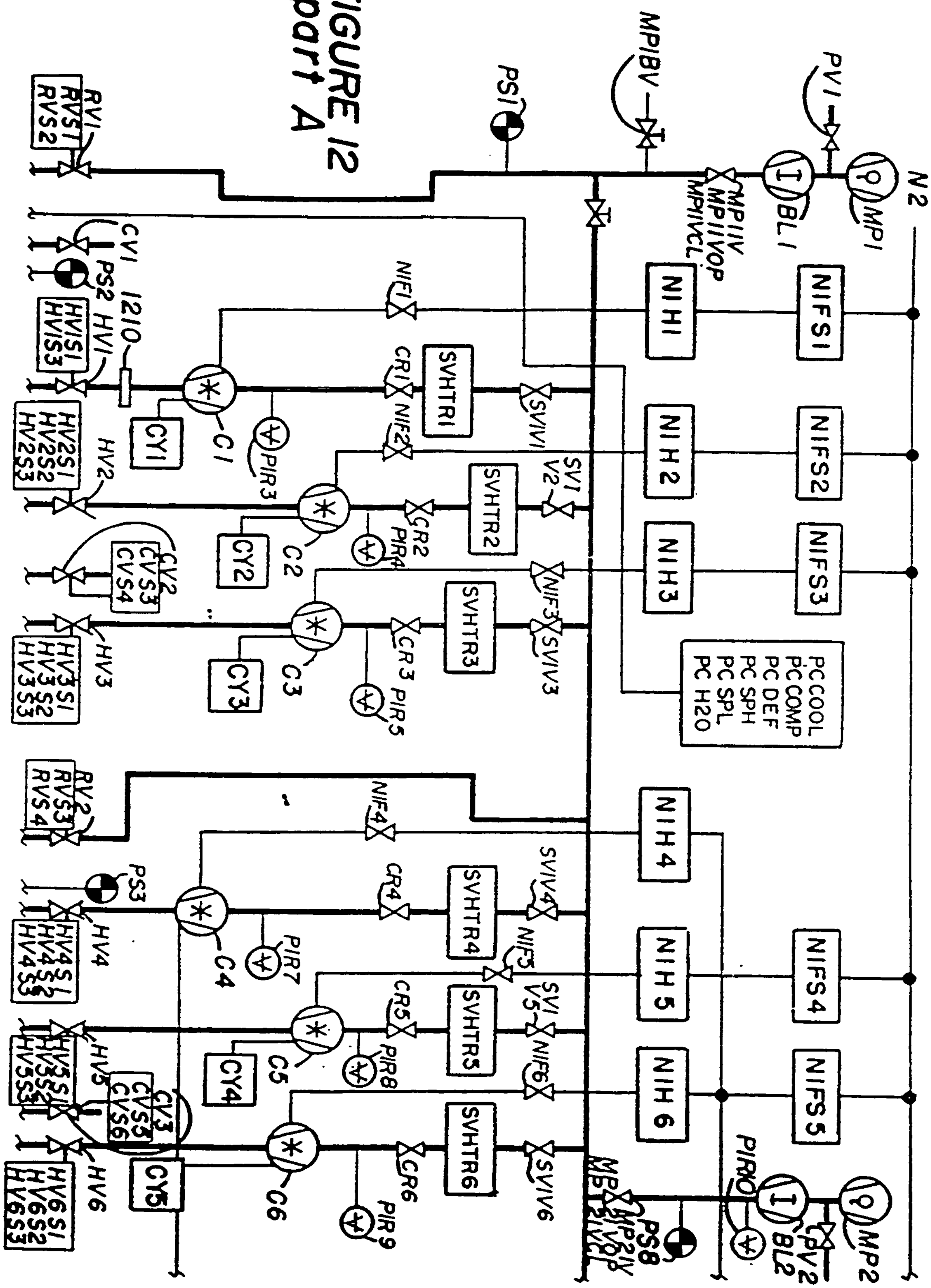


FIGURE 12
part A

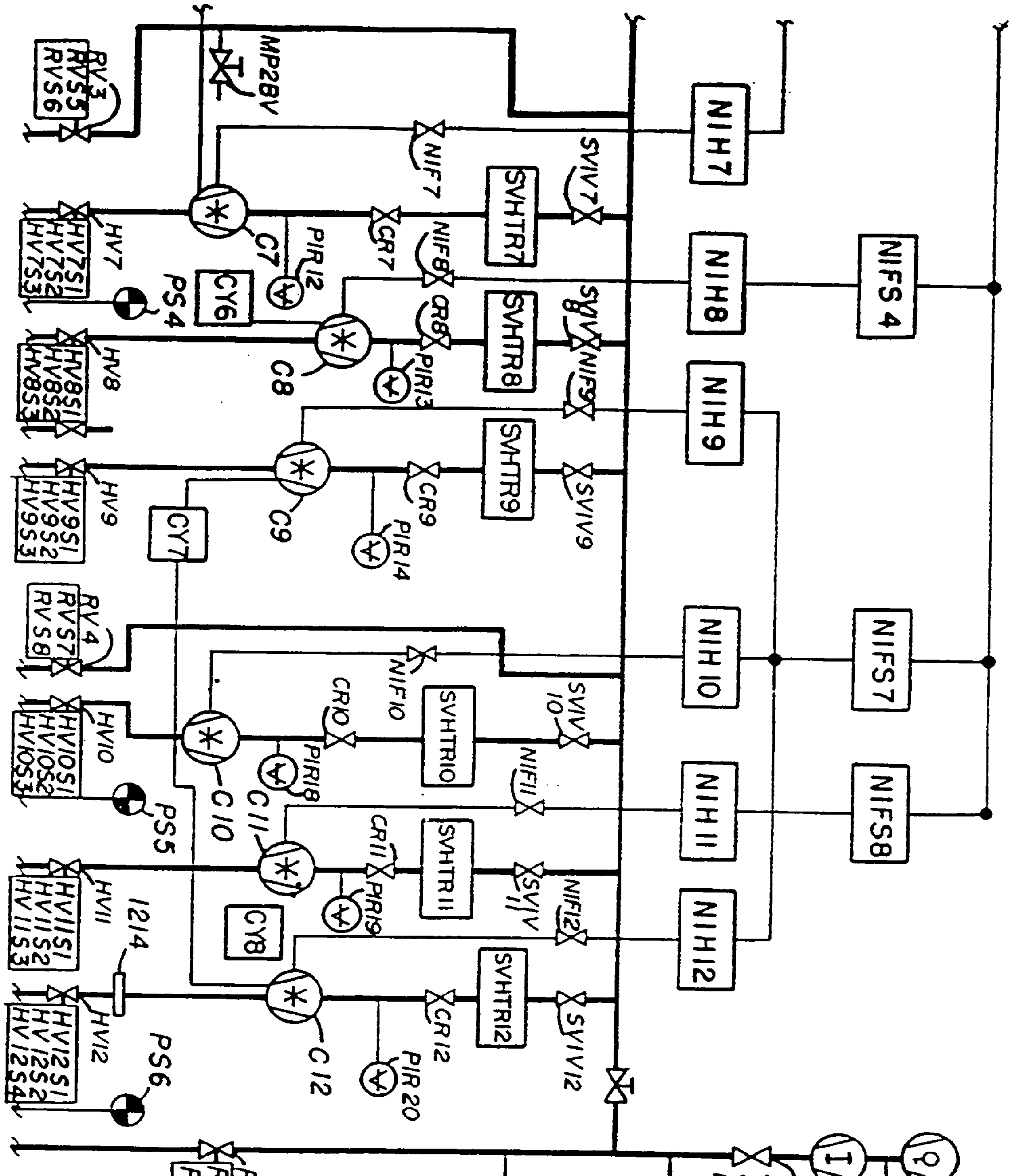


FIGURE 12 part B

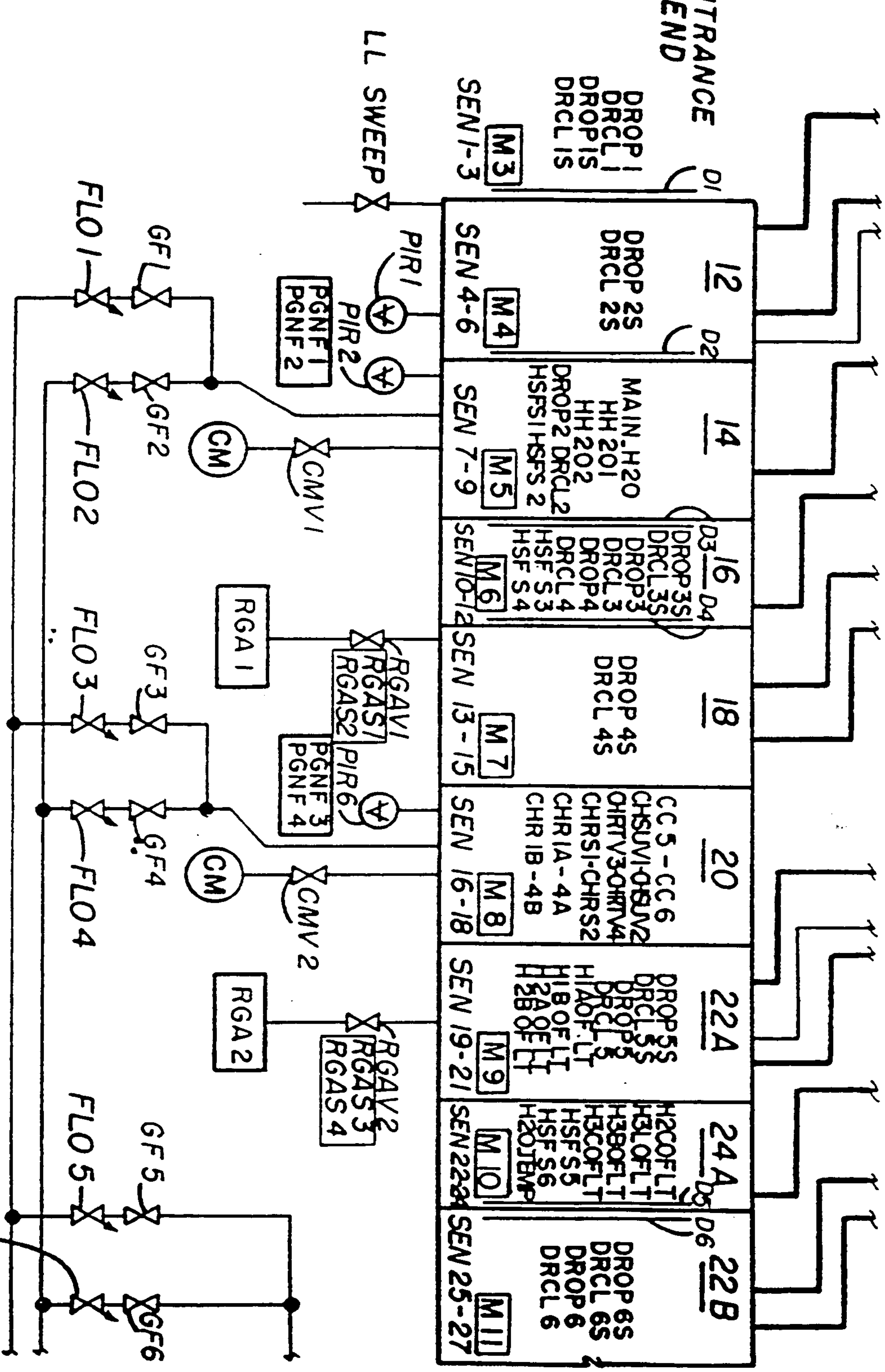


FIGURE 12
part C

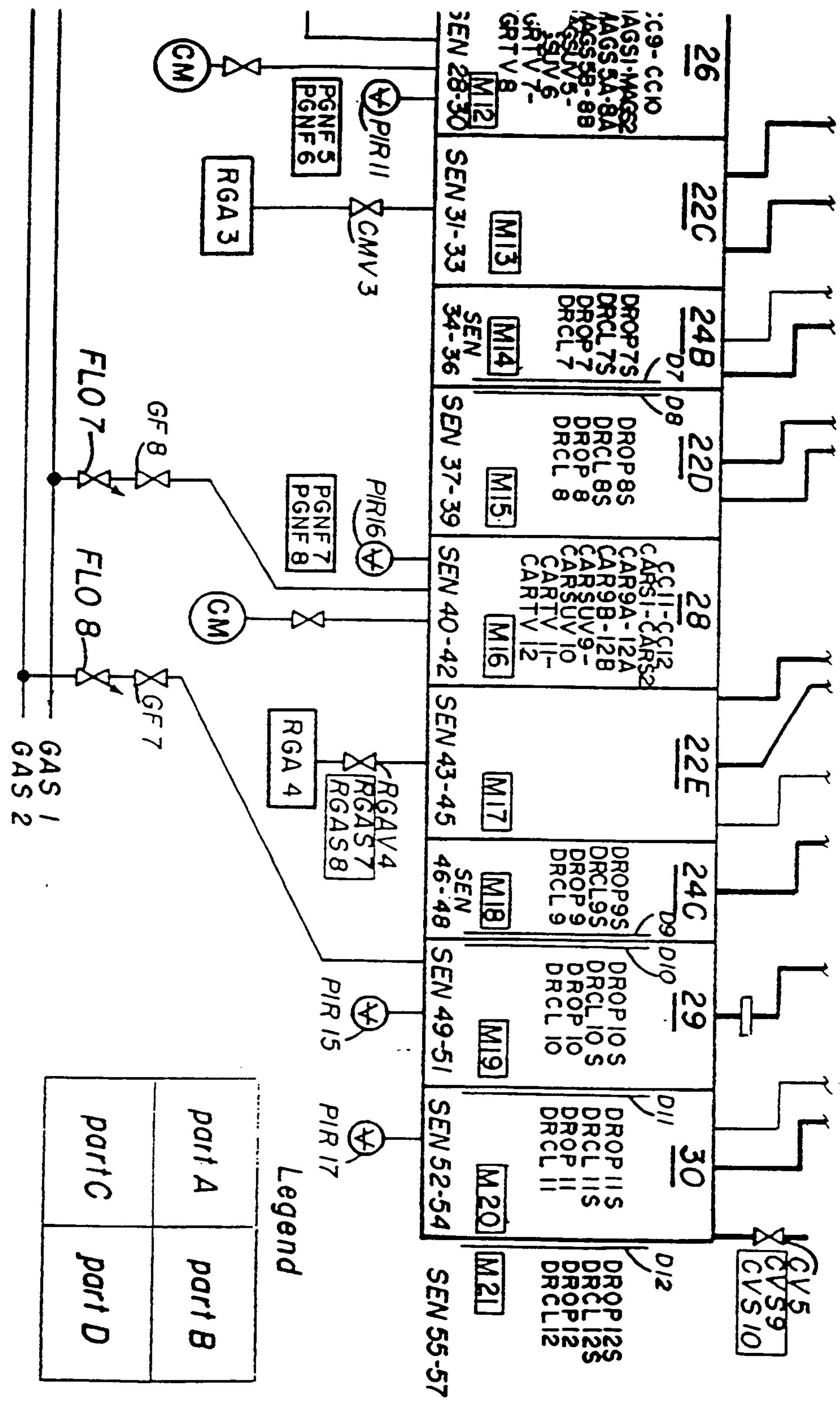


FIGURE 12
part D

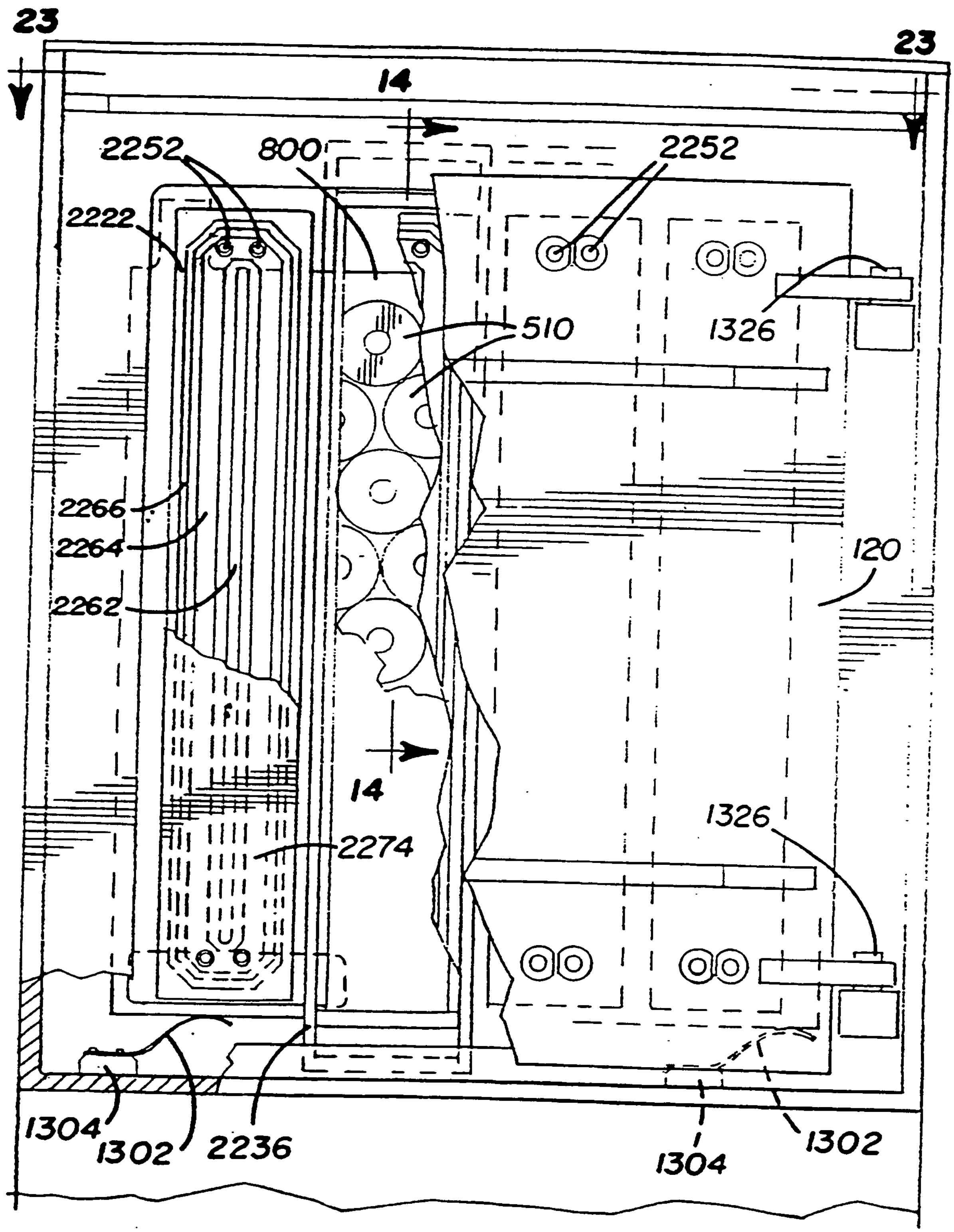

23
23
14
2252
800
2252
2222
510
1326
2266
2264
2262
120
14
1326
2274
1304
1302
2236
1304
1302

FIGURE 13

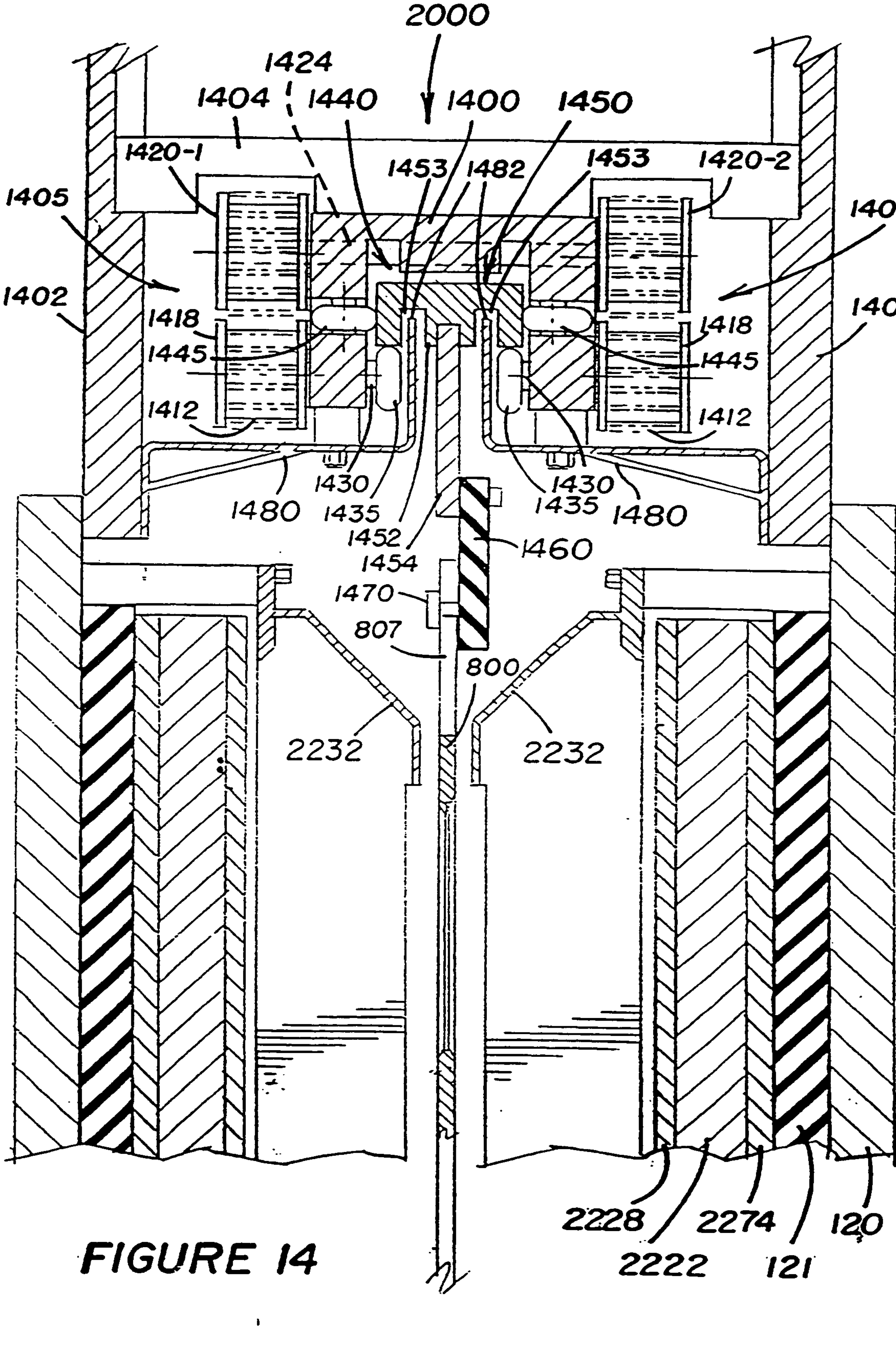

2000
1424
1404
1440
1400
1450
1420-1
1453
1482
1453
1420-2
1405
1405
1402
1418
1418
1402
1445
1445
1412
1412
1430
1430
1480
1435
1435
1480
1452
1454
1460
1470
807
800
2232
2232
2228
2274
120
2222
121

FIGURE 14

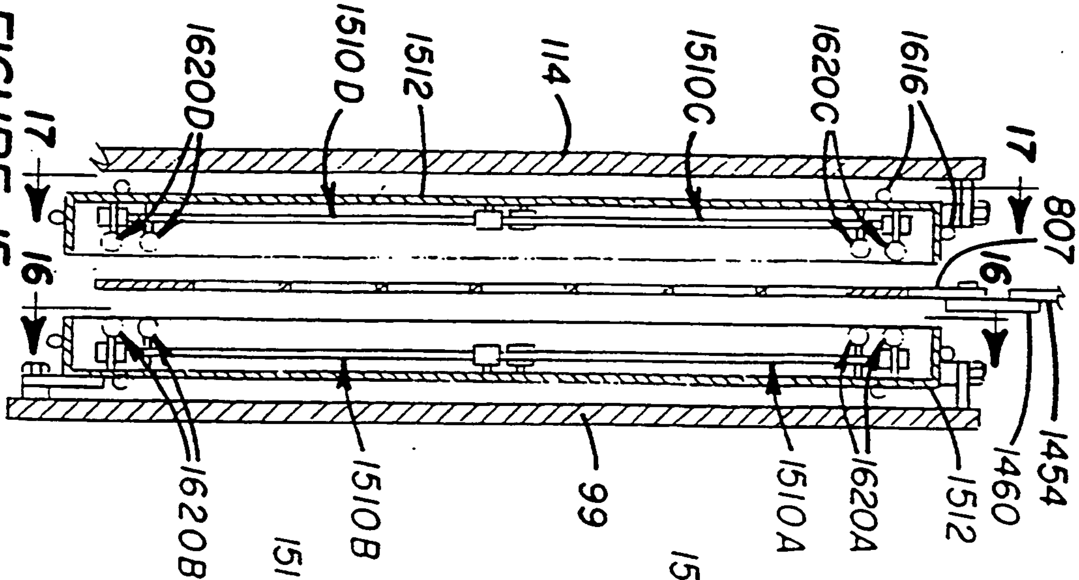


FIGURE 15

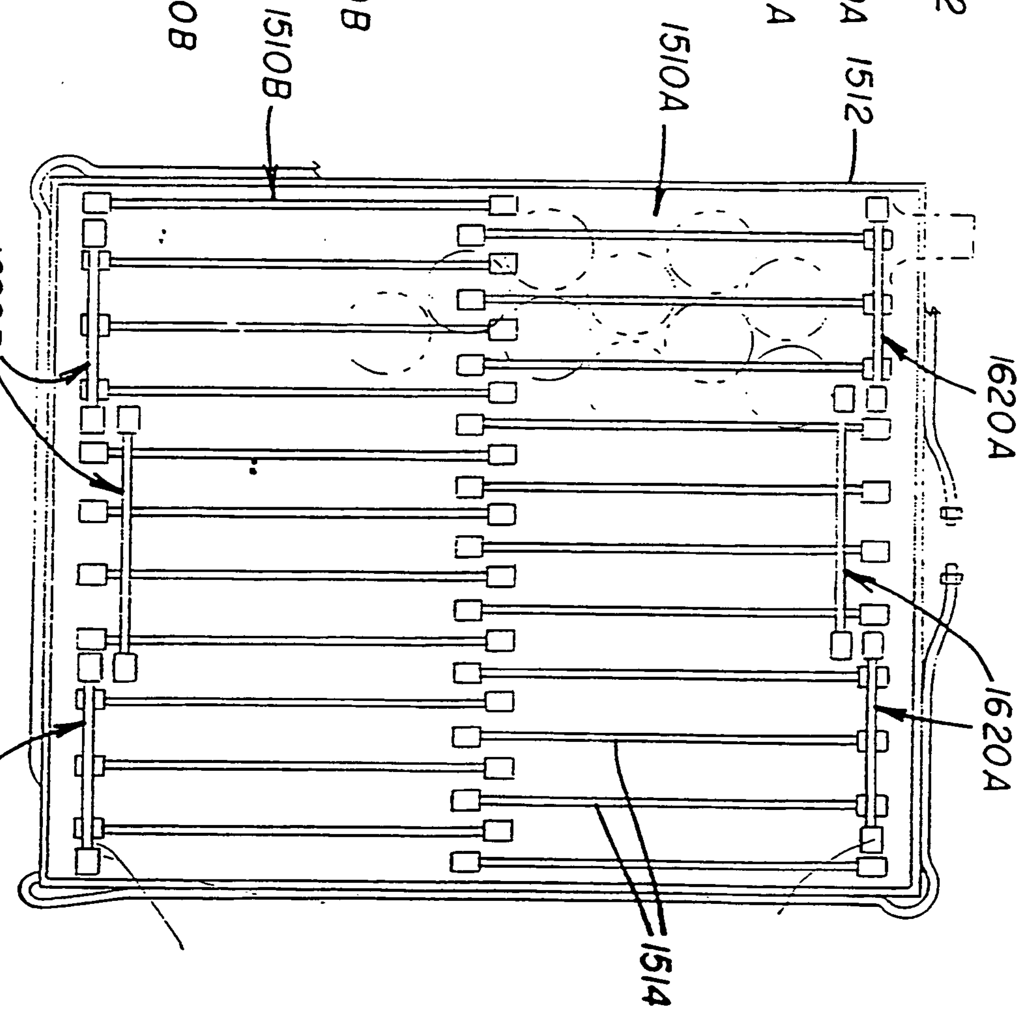


FIGURE 16

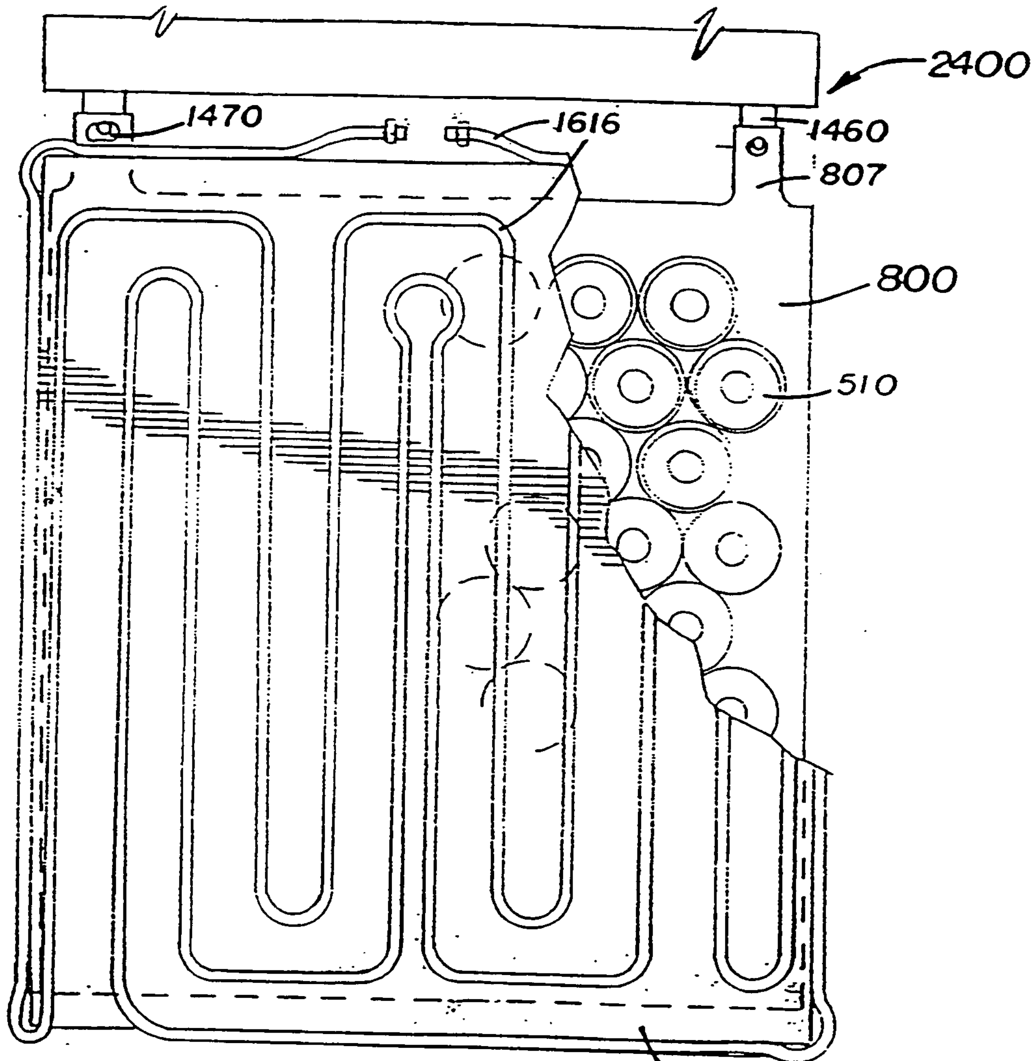


FIGURE 17

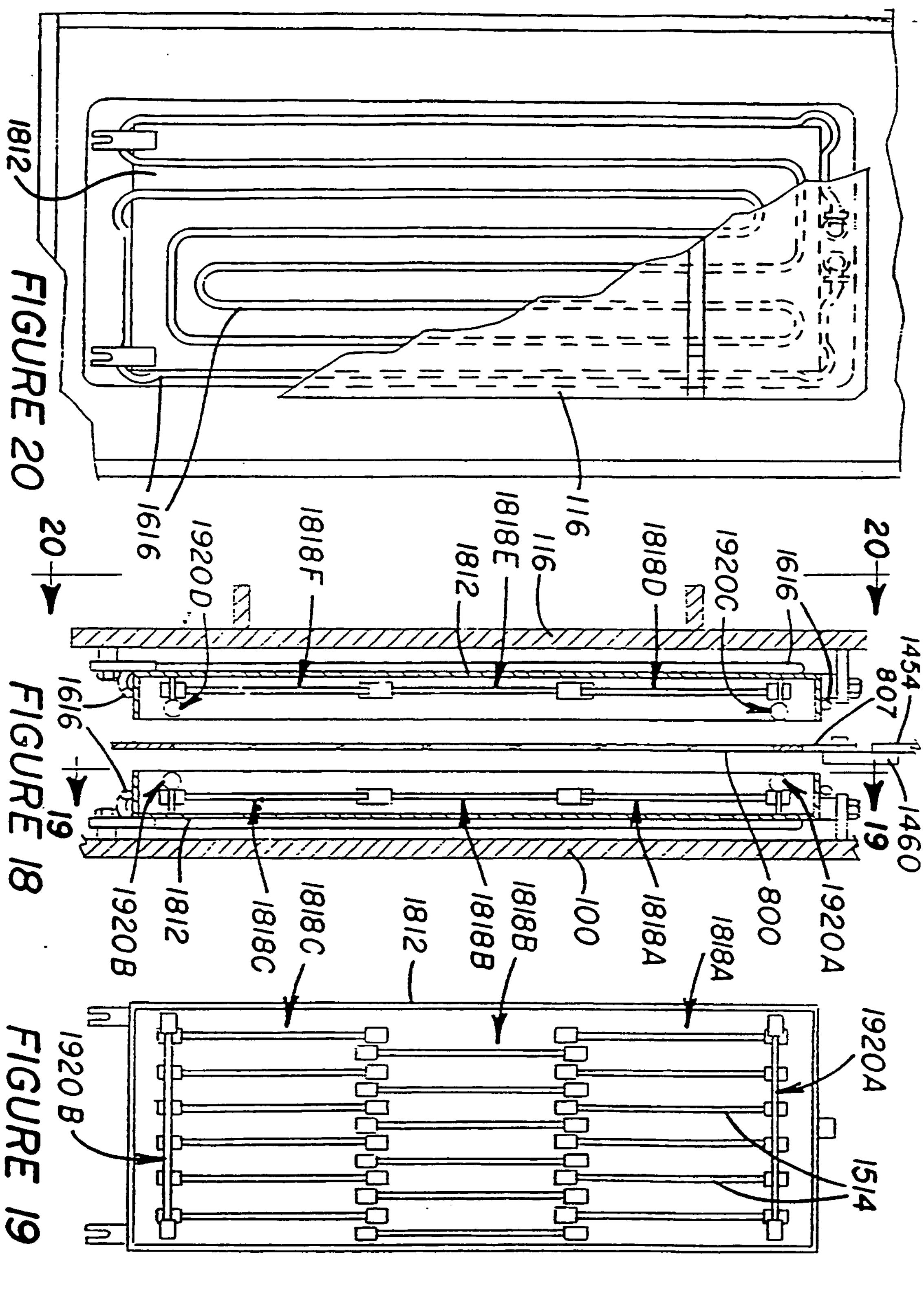


FIGURE 20

FIGURE 18

FIGURE 19

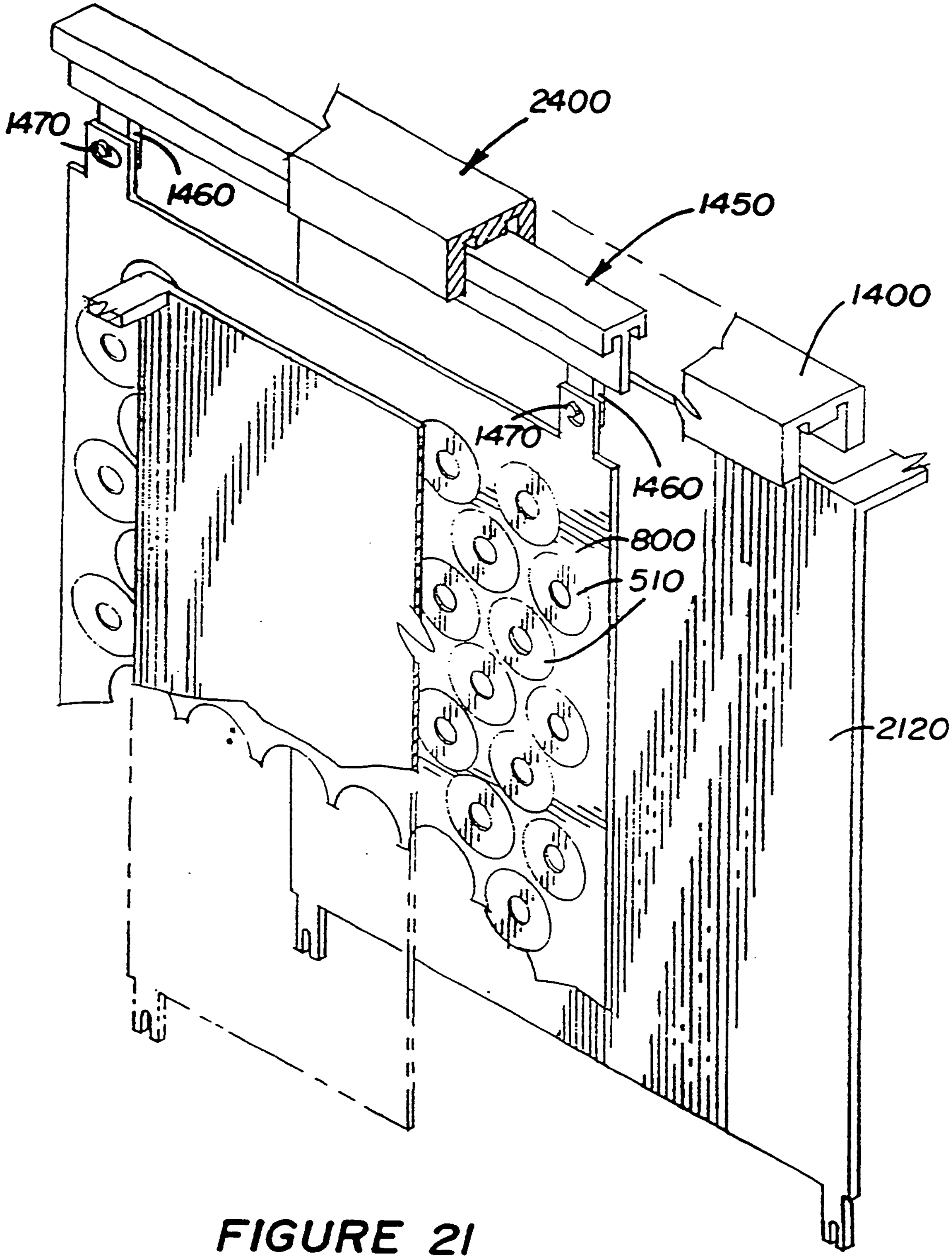
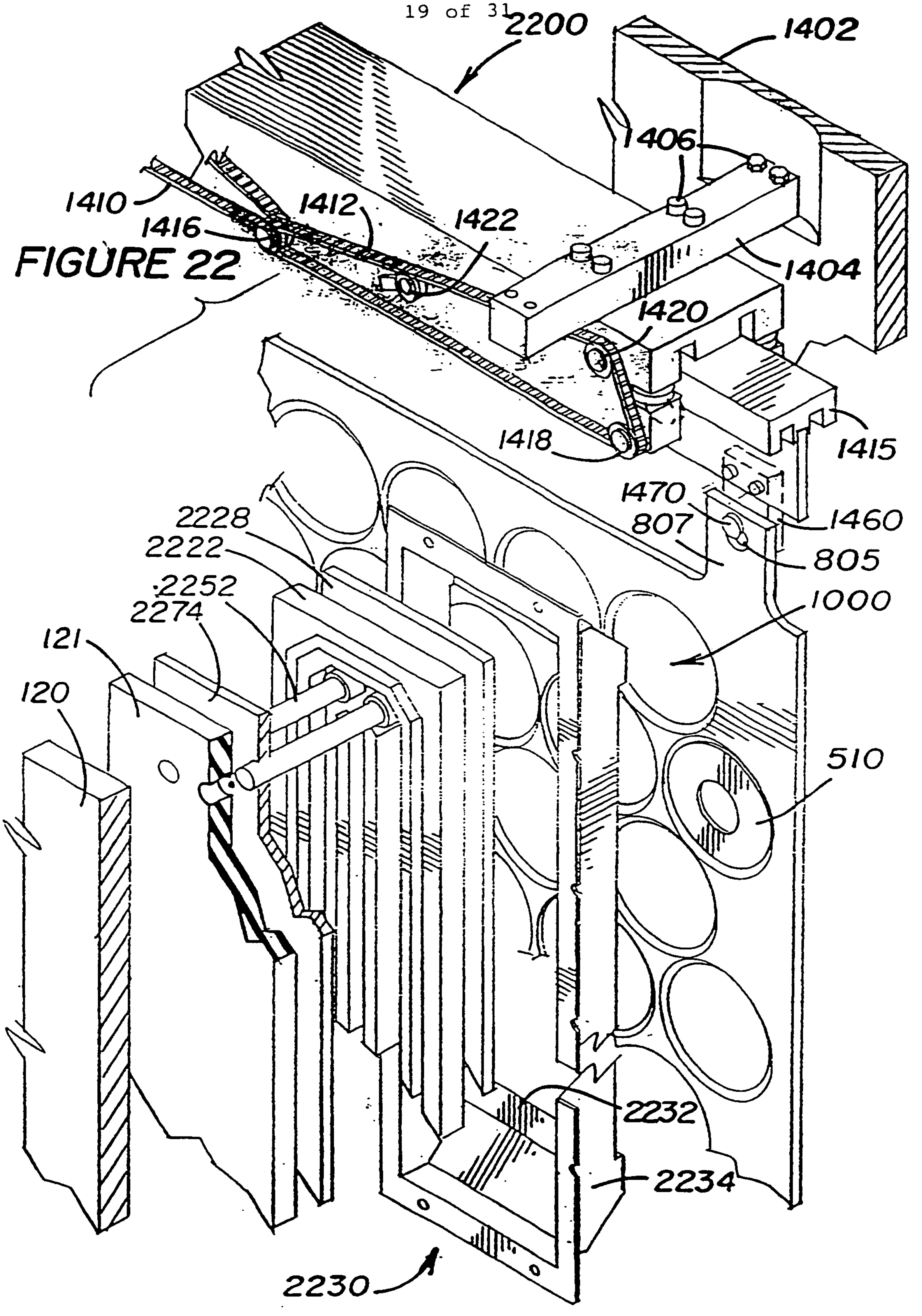


FIGURE 21



2200
1402
1406
1410
1412
1416
1422
1404
1420
1418
1415
1470
1460
807
805
2228
2222
2252
2274
1000
121
120
510
2232
2234
2230

FIGURE 22

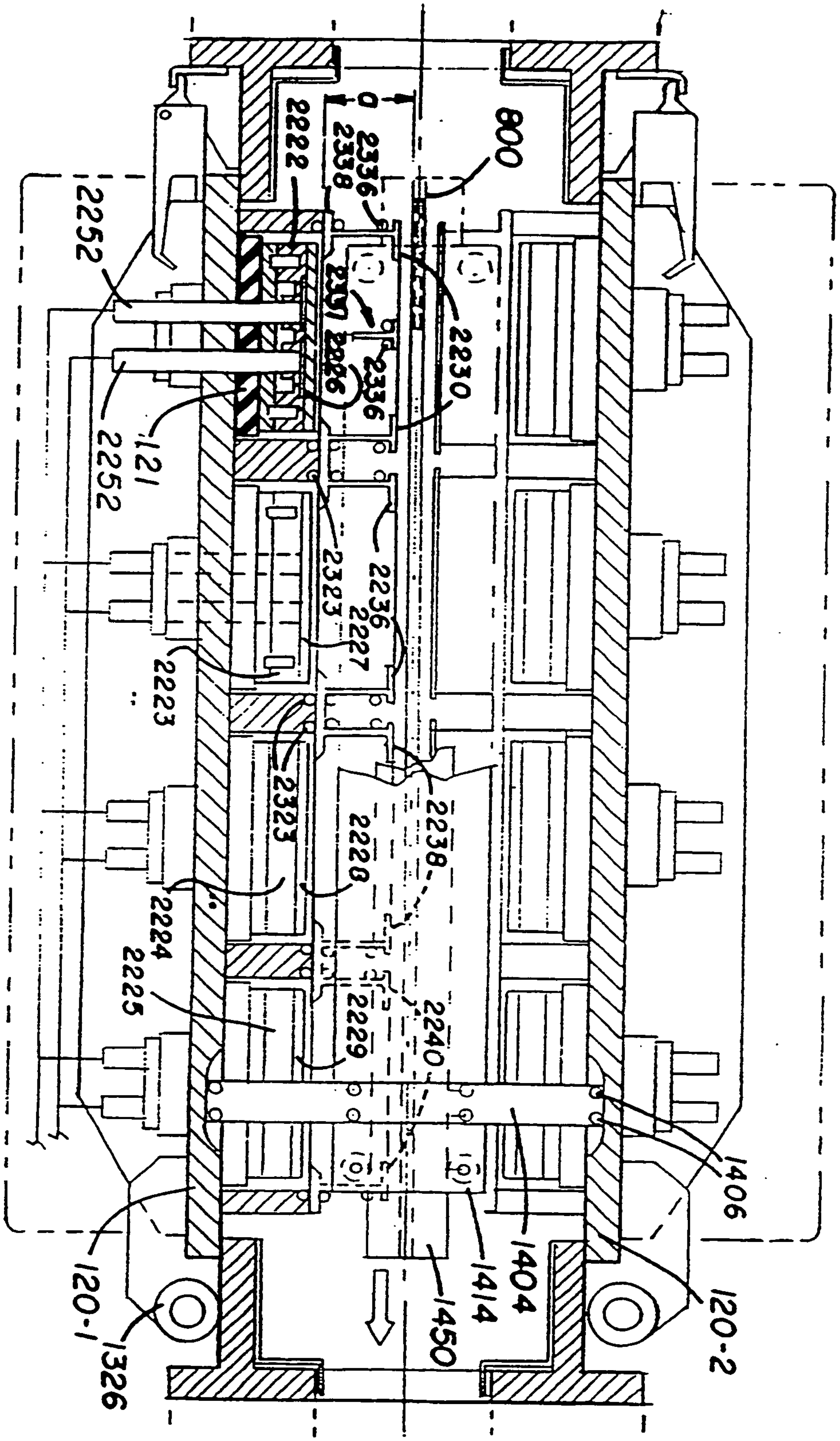

800
2336
2338
2222
a
2230
2237
2226
2336
2252
2252
121
2323
2236
2227
2223
2323
2238
2228
2224
2225
2229
2240
1406
1404
1414
1450
120-1
1326
120-2

FIGURE 23

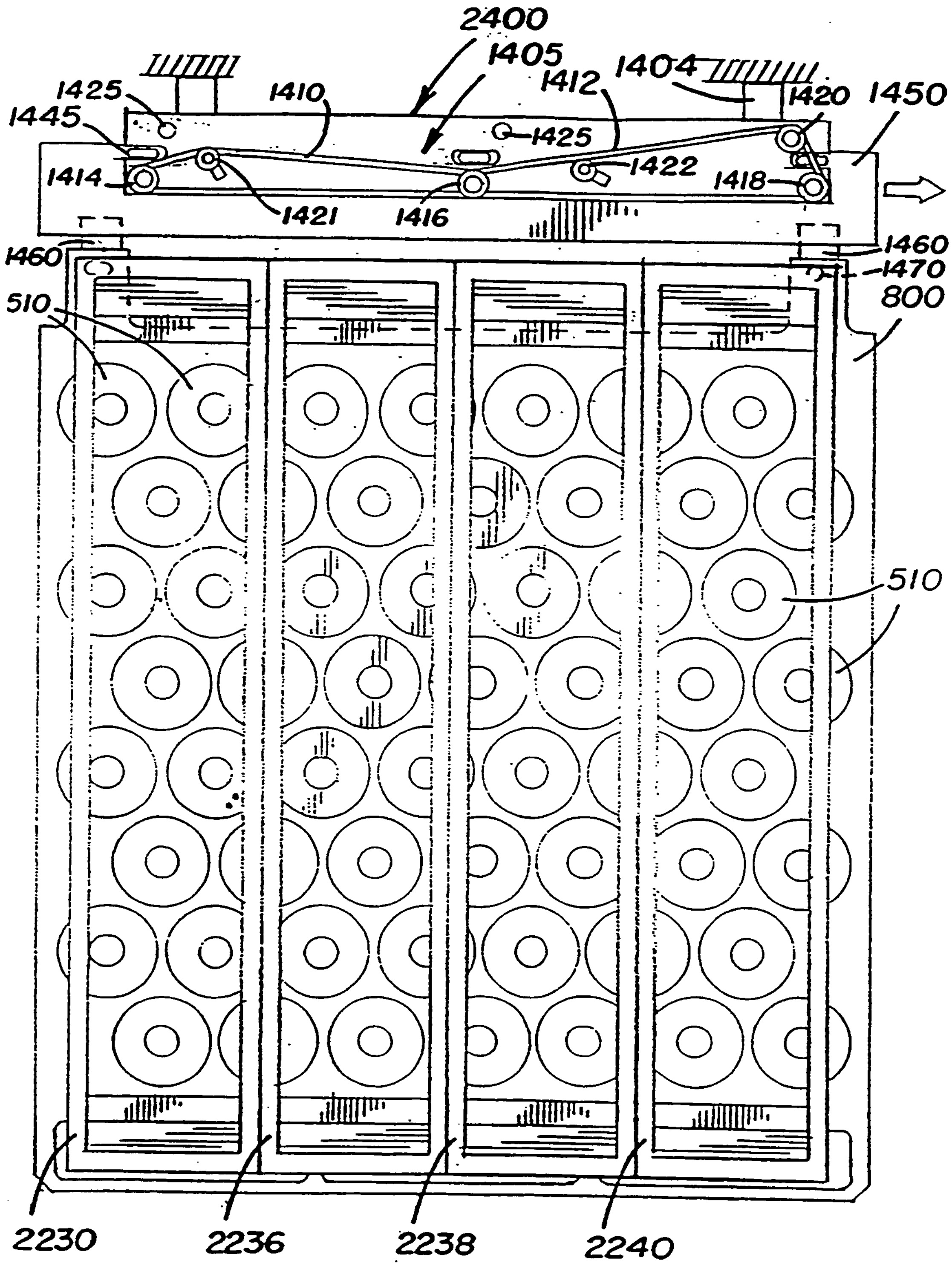

2400
1405
1404
1425
1410
1412
1420
1450
1445
1425
1414
1422
1418
1421
1416
1460
1460
1470
800
510
510
2230
2236
2238
2240

FIGURE 24

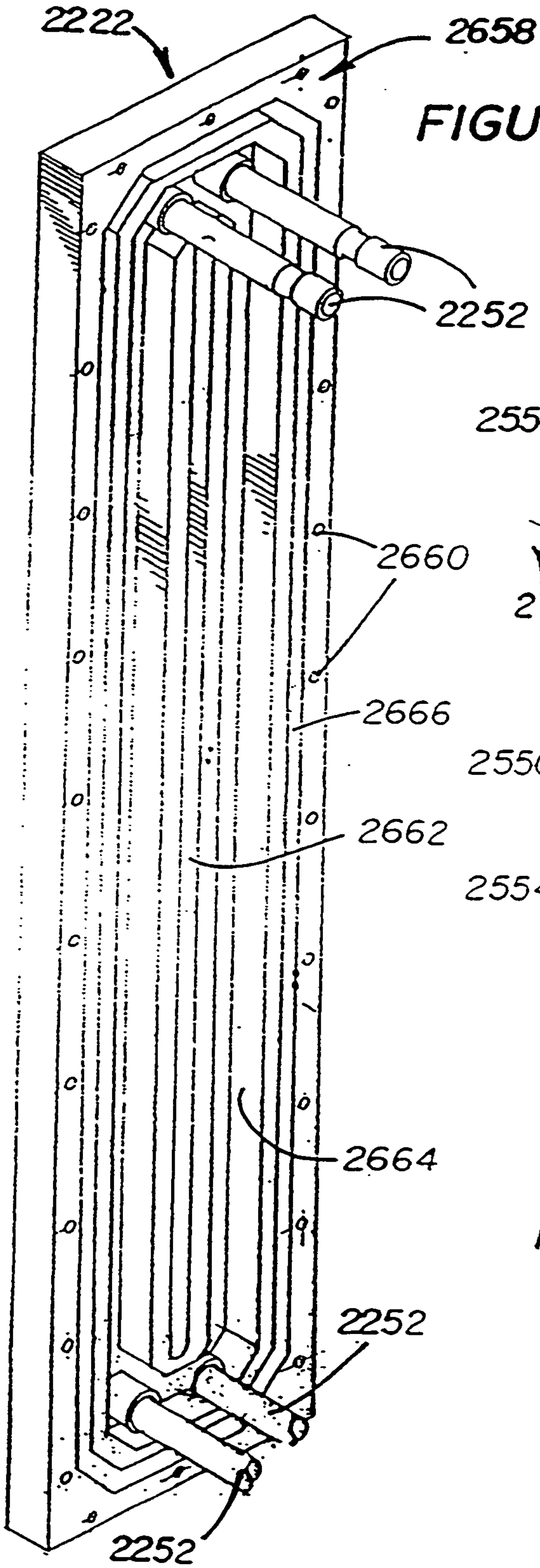


FIGURE 26

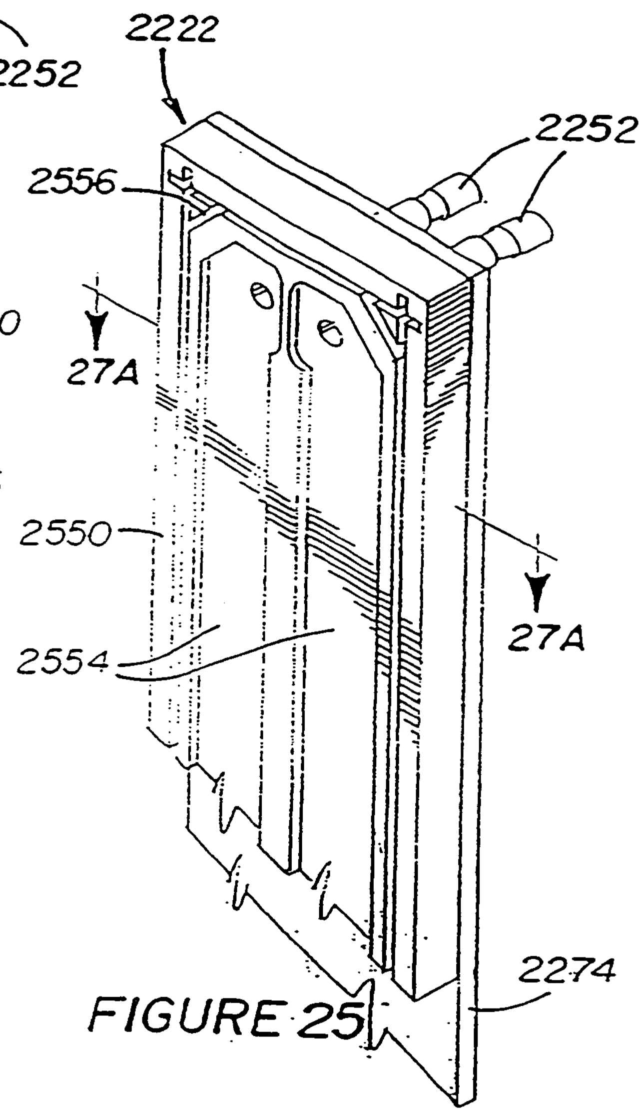


FIGURE 25

FIGURE 27A

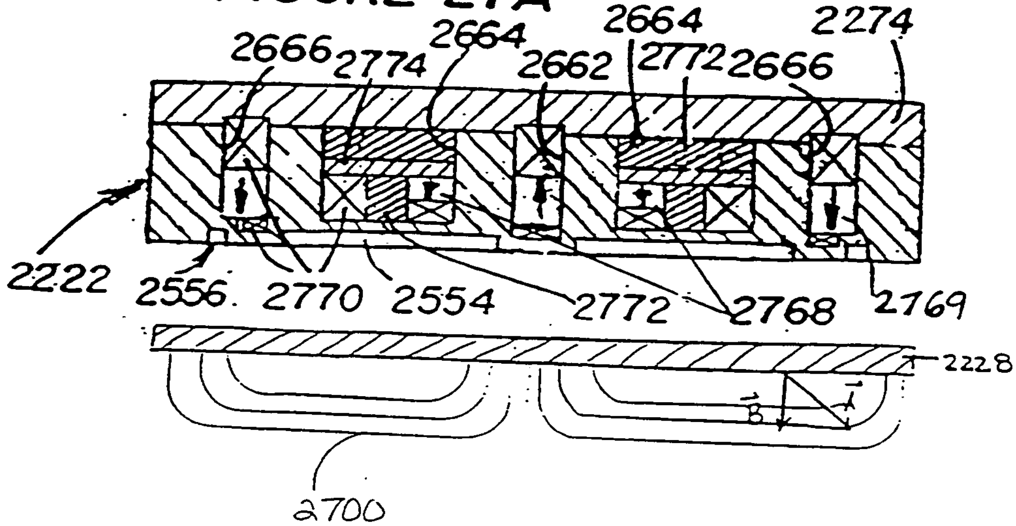
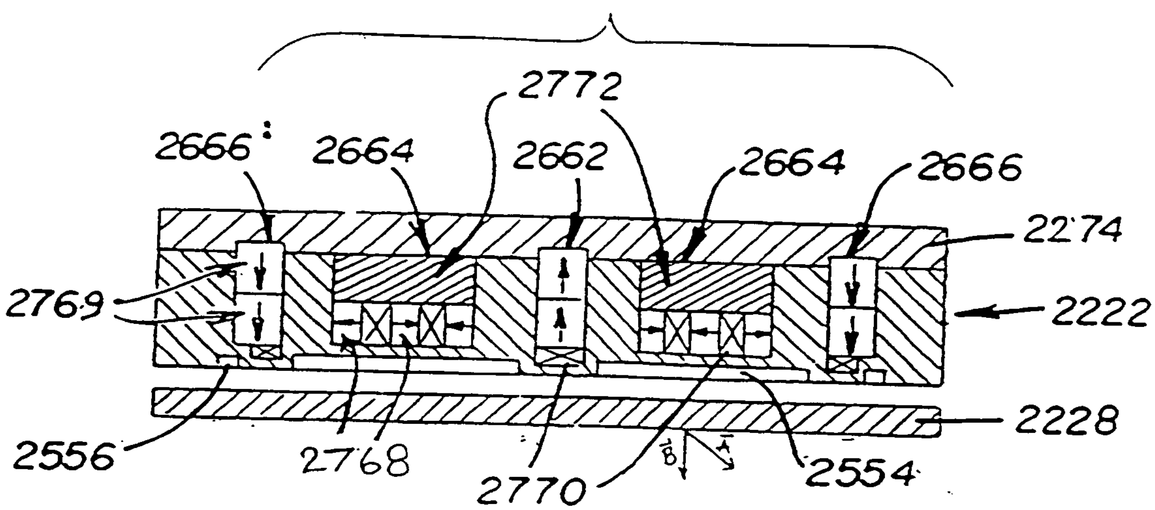


FIGURE 27B



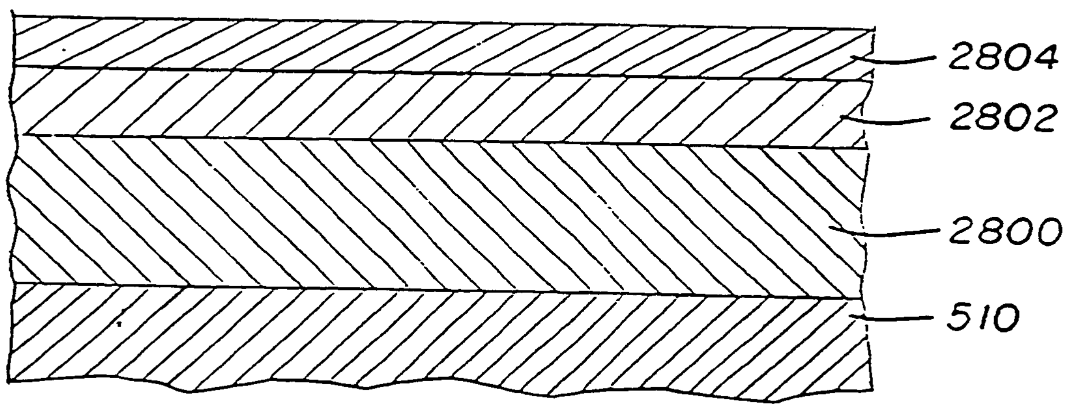


FIGURE 28

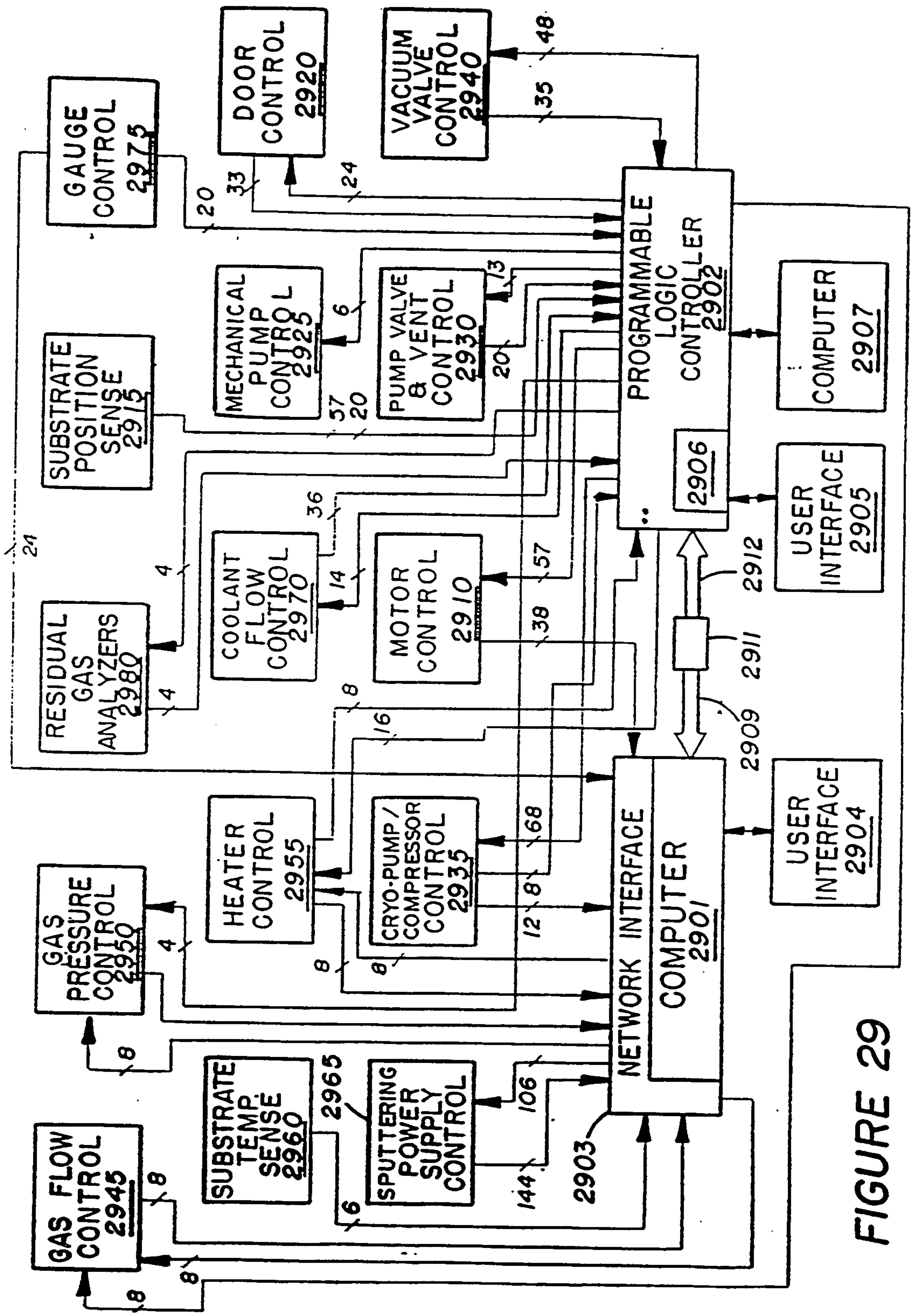

GAUGE CONTROL 2975
DOOR CONTROL 2920
VACUUM VALVE CONTROL 2940
PROGRAMMABLE LOGIC CONTROLLER 2902
2906
COMPUTER 2907
USER INTERFACE 2905
MECHANICAL PUMP CONTROL 2925
PUMP VALVE & VENT CONTROL 2930
SUBSTRATE POSITION SENSE 2915
RESIDUAL GAS ANALYZERS 2980
COOLANT FLOW CONTROL 2970
MOTOR CONTROL 2910
2912
2911
2909
NETWORK INTERFACE
COMPUTER 2901
USER INTERFACE 2904
HEATER CONTROL 2955
CRYO-PUMP/COMPRESSOR CONTROL 2935
GAS PRESSURE CONTROL 2950
GAS FLOW CONTROL 2945
SUBSTRATE TEMP. SENSE 2960
SPUTTERING POWER SUPPLY CONTROL
2965
2903
48
35
24
33
20
13
6
57
36
4
14
38
8
16
68
12
106
144

FIGURE 29

FIGURE 30

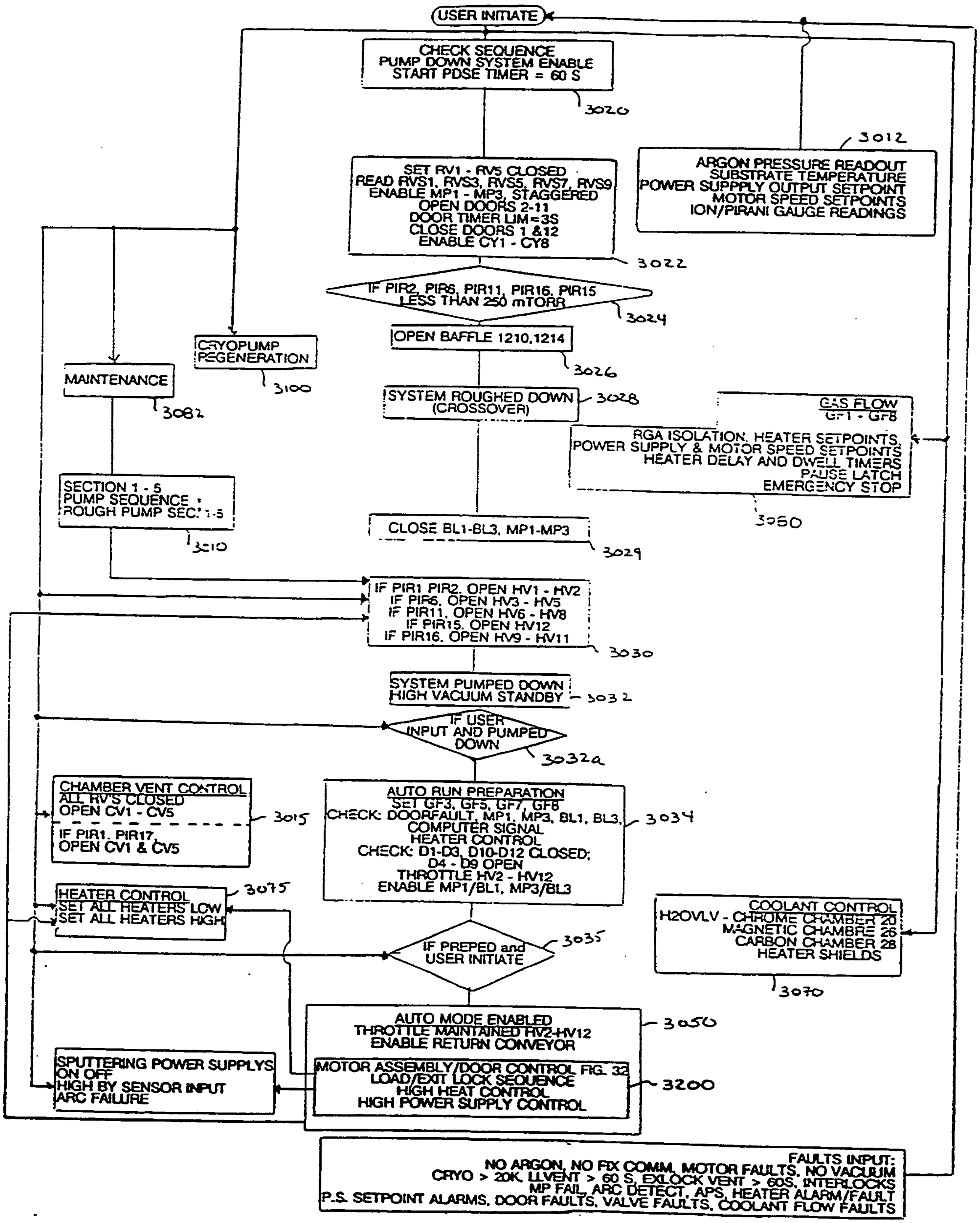
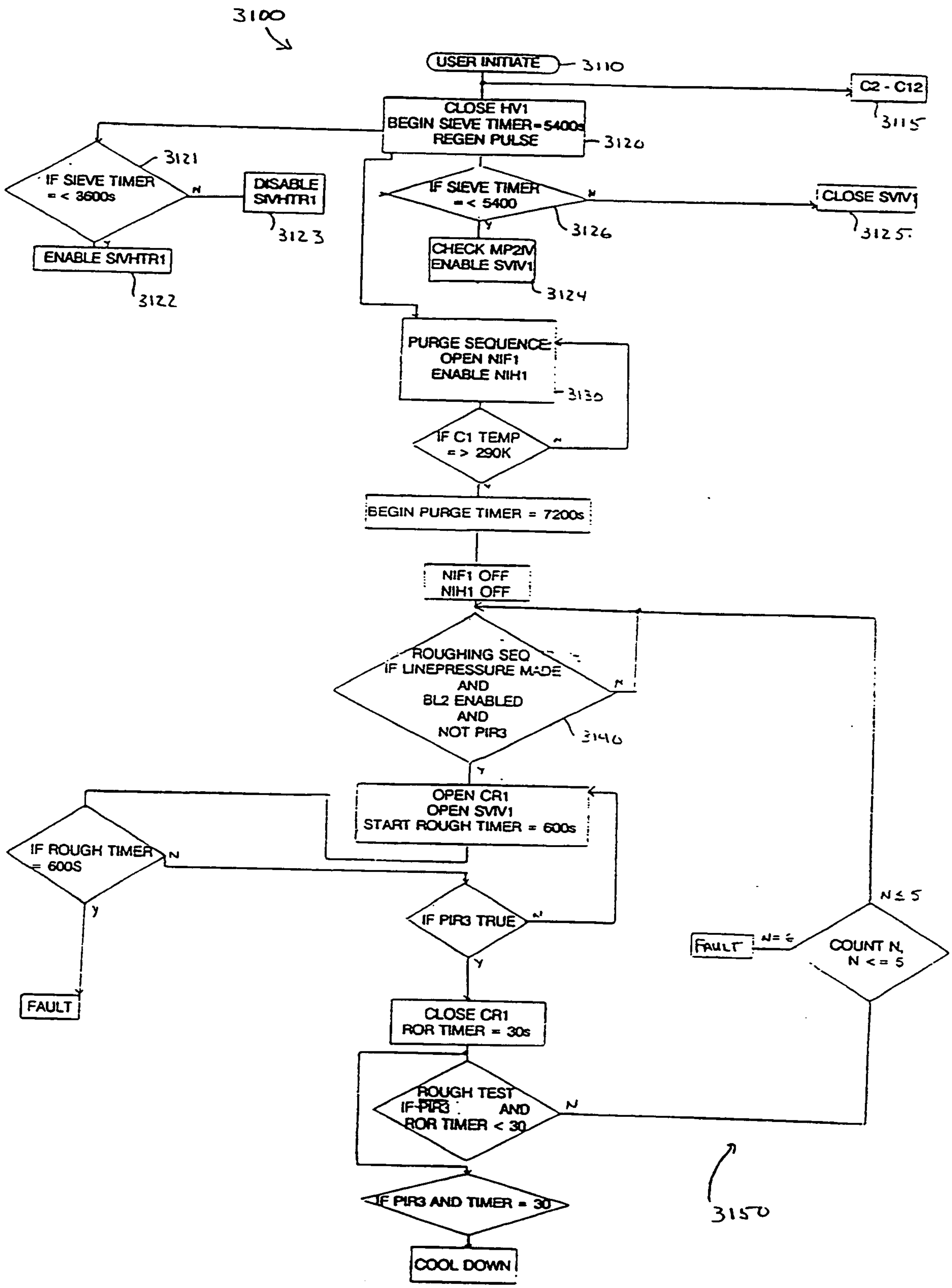

USER INITIATE
CHECK SEQUENCE
PUMP DOWN SYSTEM ENABLE
START PDSE TIMER = 60 S
3020
3012
ARGON PRESSURE READOUT
SUBSTRATE TEMPERATURE
POWER SUPPPLY OUTPUT SETPOINT
MOTOR SPEED SETPOINTS
ION/PIRANI GAUGE READINGS
SET RV1 - RV5 CLOSED
READ RVS1, RVS3, RVS5, RVS7, RVS9
ENABLE MP1 - MP3, STAGGERED
OPEN DOORS 2-11
DOOR TIMER LIM=3S
CLOSE DOORS 1 &12
ENABLE CY1 - CY8
3022
IF PIR2, PIR6, PIR11, PIR16, PIR15
LESS THAN 250 mTORR
3024
CRYOPUMP
REGENERATION
3100
OPEN BAFFLE 1210,1214
3026
MAINTENANCE
3082
SYSTEM ROUGHED DOWN
(CROSSOVER)
3028
GAS FLOW
GF1 - GF8
RGA ISOLATION, HEATER SETPOINTS,
POWER SUPPLY & MOTOR SPEED SETPOINTS
HEATER DELAY AND DWELL TIMERS
PAUSE LATCH
EMERGENCY STOP
3060
SECTION 1 - 5
PUMP SEQUENCE
ROUGH PUMP SEC 1-5
3010
CLOSE BL1-BL3, MP1-MP3
3029
IF PIR1 PIR2, OPEN HV1 - HV2
IF PIR6, OPEN HV3 - HV5
IF PIR11, OPEN HV6 - HV8
IF PIR15, OPEN HV12
IF PIR16, OPEN HV9 - HV11
3030
SYSTEM PUMPED DOWN
HIGH VACUUM STANDBY
3032
IF USER
INPUT AND PUMPED
DOWN
3032a
CHAMBER VENT CONTROL
ALL RV'S CLOSED
OPEN CV1 - CV5
IF PIR1, PIR17,
OPEN CV1 & CV5
3015
AUTO RUN PREPARATION
SET GF3, GF5, GF7, GF8
CHECK: DOORFAULT, MP1, MP3, BL1, BL3,
COMPUTER SIGNAL
HEATER CONTROL
CHECK: D1-D3, D10-D12 CLOSED;
D4 - D9 OPEN
THROTTLE HV2 - HV12
ENABLE MP1/BL1, MP3/BL3
3034
HEATER CONTROL
SET ALL HEATERS LOW
SET ALL HEATERS HIGH
3075
COOLANT CONTROL
H2OVLV - CHROME CHAMBER 20
MAGNETIC CHAMBRE 26
CARBON CHAMBER 28
HEATER SHIELDS
3070
IF PREPED and
USER INITIATE
3035
AUTO MODE ENABLED
THROTTLE MAINTAINED HV2-HV12
ENABLE RETURN CONVEYOR
3050
SPUTTERING POWER SUPPLYS
ON OFF
HIGH BY SENSOR INPUT
ARC FAILURE
MOTOR ASSEMBLY/DOOR CONTROL FIG. 32
LOAD/EXIT LOCK SEQUENCE
HIGH HEAT CONTROL
HIGH POWER SUPPLY CONTROL
3200
FAULTS INPUT:
NO ARGON, NO FIX COMM, MOTOR FAULTS, NO VACUUM
CRYO > 20K, LLVENT > 60 S, EXLOCK VENT > 60S, INTERLOCKS
MP FAIL, ARC DETECT, APS, HEATER ALARM/FAULT
P.S. SETPOINT ALARMS, DOOR FAULTS, VALVE FAULTS, COOLANT FLOW FAULTS

FIGURE 31



3100
USER INITIATE
3110
C2 - C12
3115
CLOSE HV1
BEGIN SIEVE TIMER = 5400s
REGEN PULSE
3120
IF SIEVE TIMER =< 3600s
3121
N
DISABLE SIVHTR1
3123
Y
ENABLE SIVHTR1
3122
IF SIEVE TIMER =< 5400
N
CLOSE SVIV1
3125
3126
Y
CHECK MP2IV
ENABLE SVIV1
3124
PURGE SEQUENCE
OPEN NIF1
ENABLE NIH1
3130
IF C1 TEMP => 290K
N
Y
BEGIN PURGE TIMER = 7200s
NIF1 OFF
NIH1 OFF
ROUGHING SEQ
IF LINEPRESSURE MADE
AND
BL2 ENABLED
AND
NOT PIR3
N
3140
Y
OPEN CR1
OPEN SVIV1
START ROUGH TIMER = 600s
IF ROUGH TIMER = 600S
N
Y
FAULT
IF PIR3 TRUE
N
Y
CLOSE CR1
ROR TIMER = 30s
ROUGH TEST
IF PIR3 AND
ROR TIMER < 30
N
IF PIR3 AND TIMER = 30
COOL DOWN
N ≤ 5
COUNT N,
N <= 5
N = 6
FAULT
3150

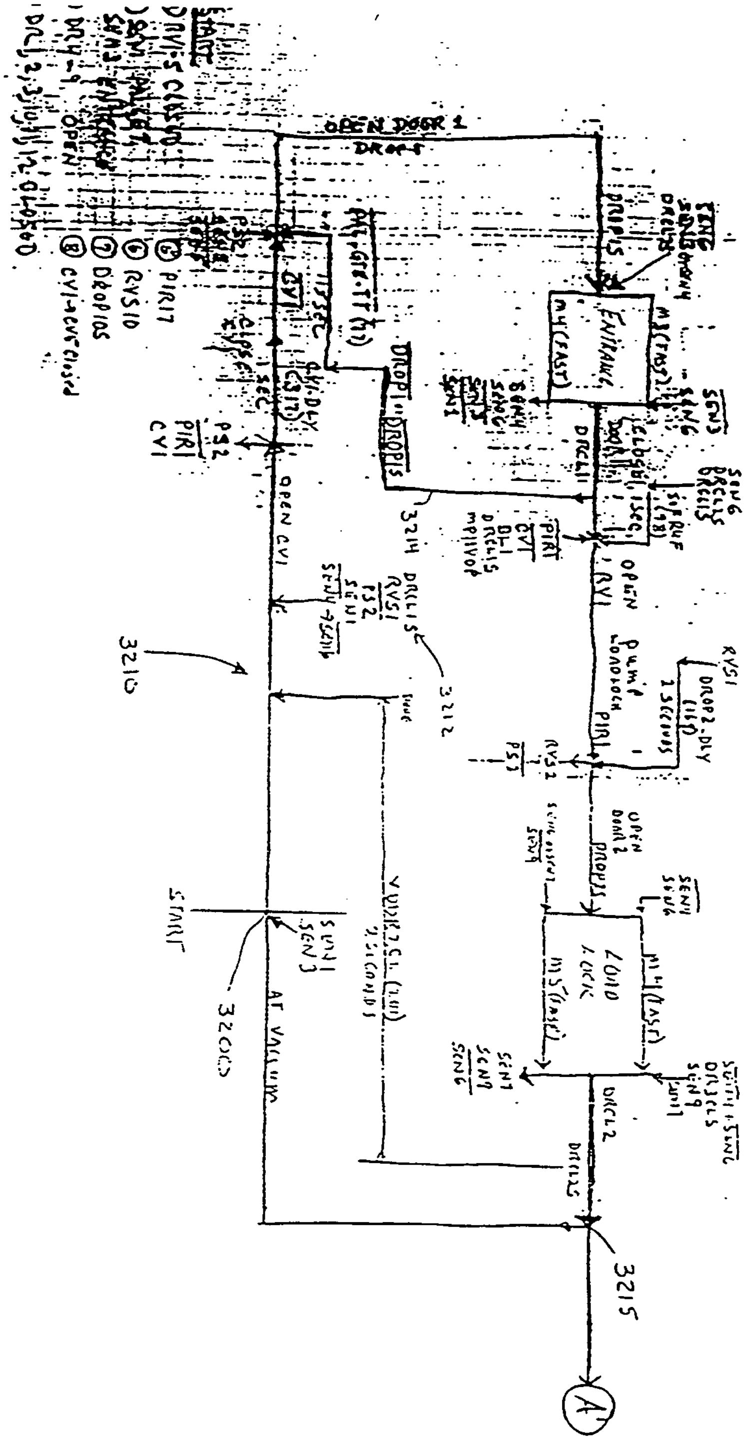


FIGURE 32A

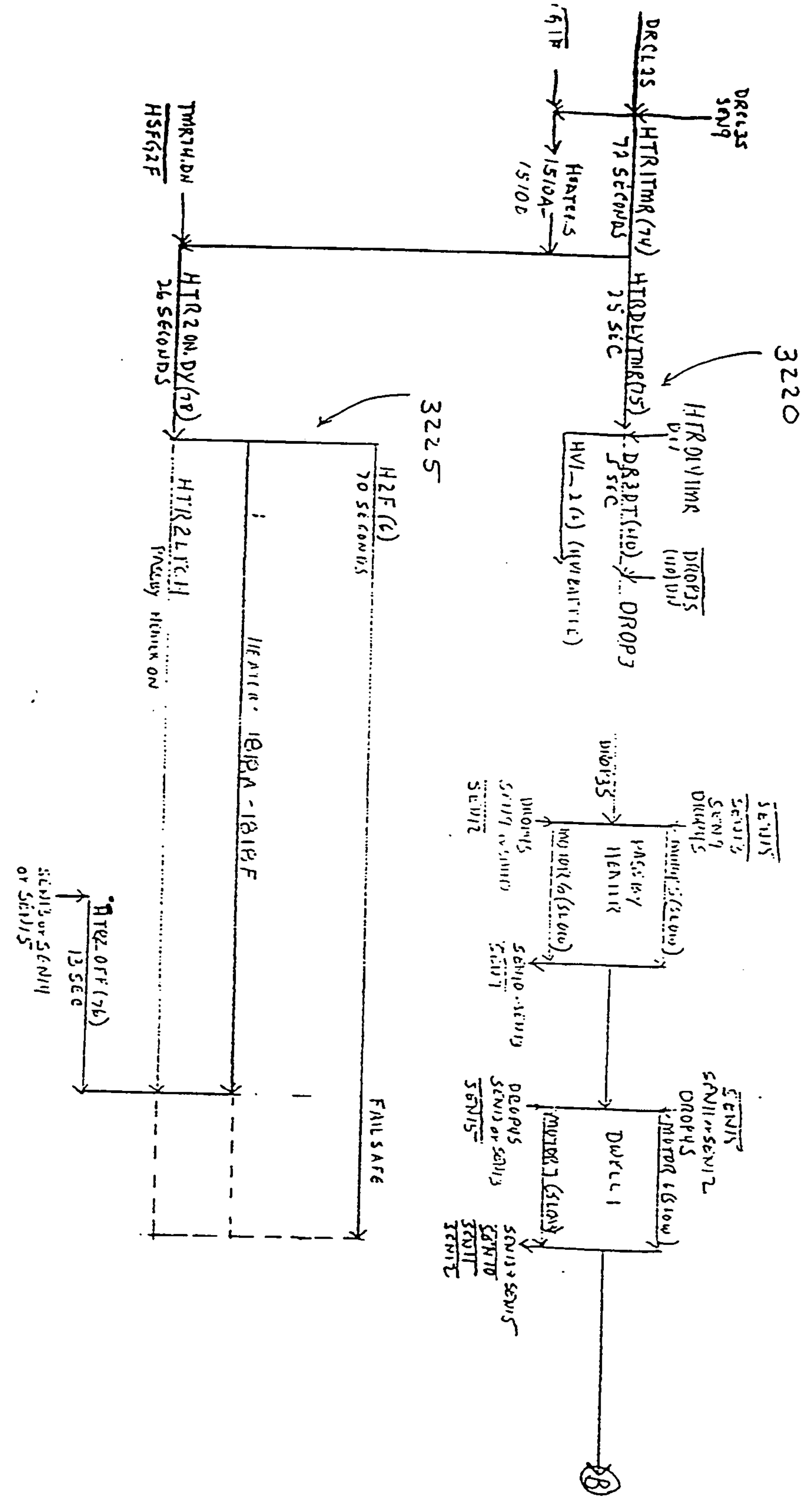

3220
3225
72 SECONDS
25 SEC
70 SECONDS
26 SECONDS
13 SEC
FAILSAFE
DWELL 1

FIGURE 32B

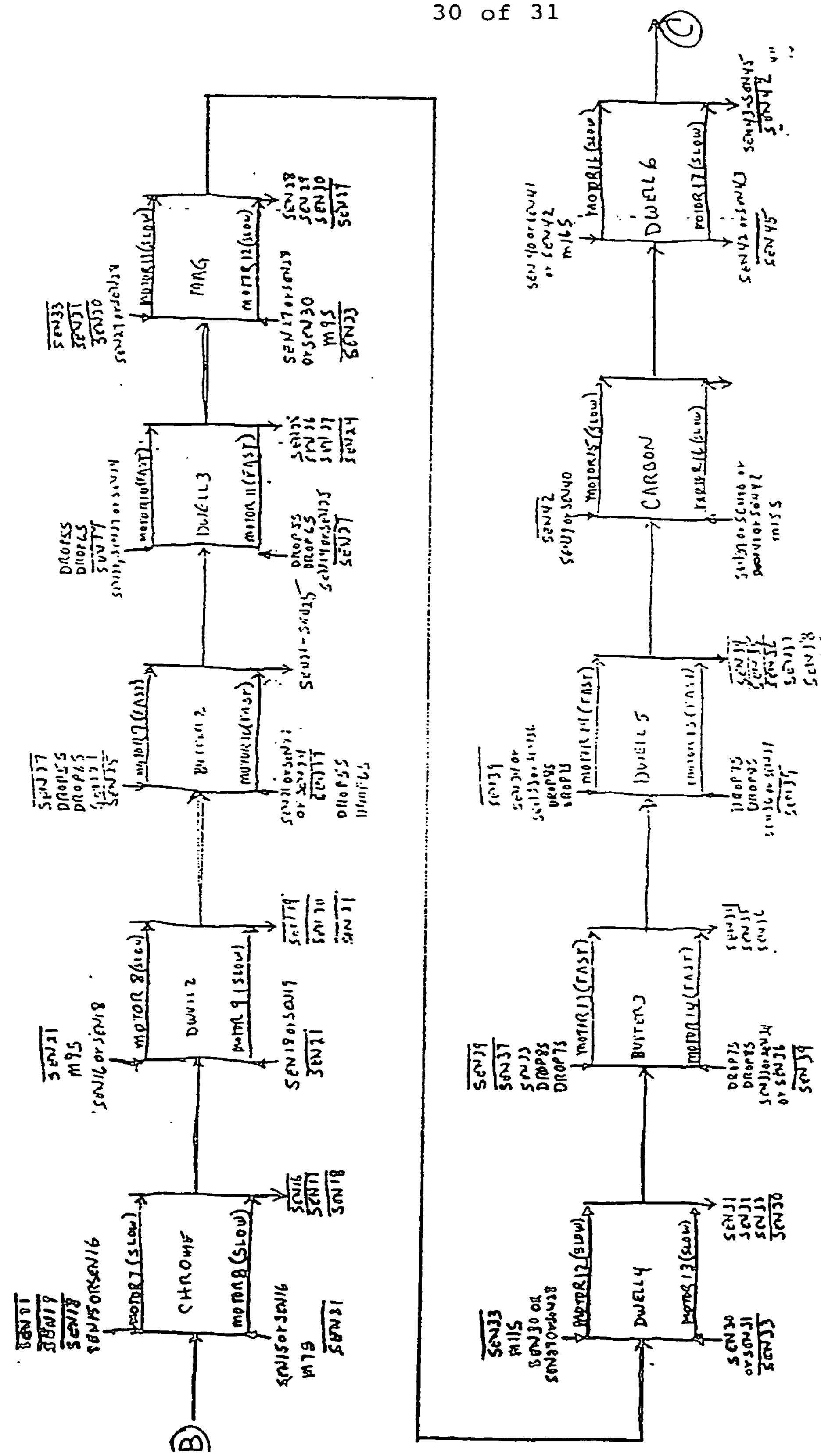

CHROME
DWELL 2
BUFFER 2
DWELL 3
MAG
DWELL 4
BUFFER 3
DWELL 5
CARBON
DWELL 6

FIGURE 32C

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US92/00722

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5): C23C 14/34
US CL : 204/192.125,298.23

II. FIELDS SEARCHED

Minimum Documentation Searched[4]

Classification System	Classification Symbols
U.S.	204/192.12,192.16,192.2,298.23,298.25,298.26,298.27,298.09

Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched[5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[14]

Category*	Citation of Document,[16] with indication, where appropriate, of the relevant passages[17]	Relevant to Claim No. [18]
X	US, A, 4,663,009 (BLOOMQUIST ET AL.) 05 May 1987, see the entire document.	1-4
X	US, A, 4,749,465 (FLINT ET AL.) 07 June 1988, see the entire document.	1-4
Y	US, A, 4,894,133 (HEDGCOTH) 16 January 1990, see columns 7 and 8.	5

* Special categories of cited documents:[15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search[2]	Date of Mailing of this International Search Report[2]
29 JUNE 1992	31 JUL 1992
International Searching Authority[1]	**Signature of Authorized Officer**[20]
ISA/US	NAM X. NGUYEN

Form PCT/ISA/210 (second sheet)(May 1986) ß

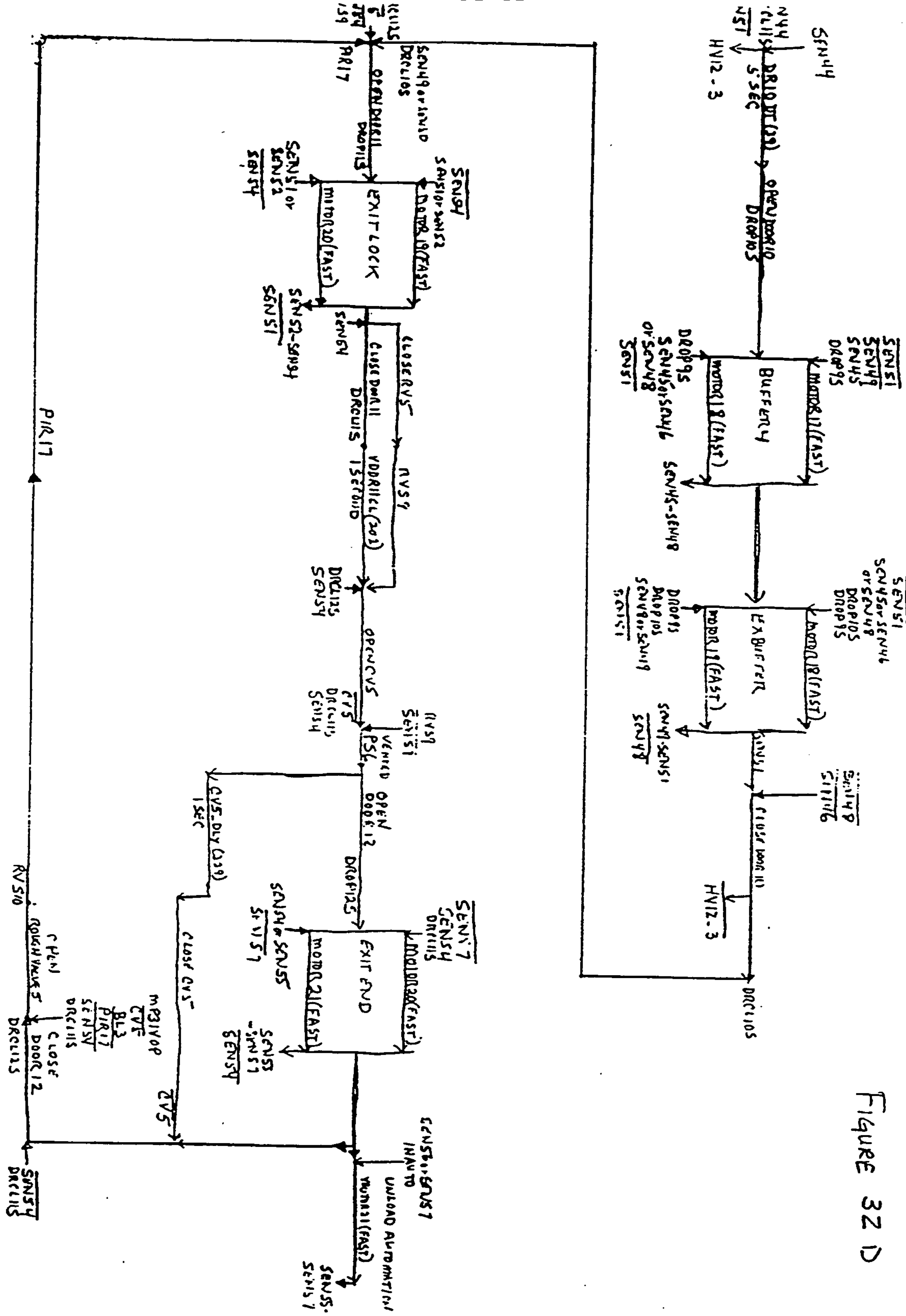


FIGURE 32 D